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COMMUNICATIONS & TECHNOLOGY

FEBRUARY 2001

CQ

OSCAR-40 in Trouble, p.11

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On the cover: Bob Magnani, of Santa Rosa, California is dwarfed by his 6 meter moonbounce (EME) array, d's largest. Details on p. 118; n p. 52.

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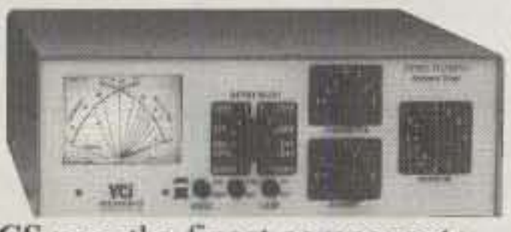

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Ham Radio News

From The CQ Newsroom

String of Problems Silences OSCAR-40

Ham radio's super-satellite may be dead, although nothing was certain as we went to press. For up-to-press-time details, see KC4YER's "Amateur Satellites" column on page 11 and "Zero Bias" on page 6 of this issue, and monitor the *CQ* website for late-breaking reports.

Random, School Contacts From Space Station

Astronauts and cosmonauts aboard Space Station Alpha have been active on the ham bands when off duty, making at least one random contact and one scheduled school contact. Details on the first random contact are in KG3N's first-person report on page 29, and you'll find more on the first school contact in N6CL's "VHF Plus" column on page 73.

ARISS Team Meets To Plot Future Course

A group of hams responsible for making sure that amateur radio was a part of the International Space Station from the beginning met recently to set up an organizational framework and set plans for the future. According to news reports, delegates from several countries met in early December at the Goddard Space Flight Center in Maryland, and elected NASA/AMSAT official Frank Bauer, KA3HDO, to a two-year term as chairman.

Frequencies for public contacts are posted on the ARISS website at <http://ariss.gsfc.nasa.gov>.

The group also approved sending up a new and more powerful station using upgraded Mir equipment, including a mobile transceiver and slow-scan TV equipment, sometime this spring. (See the story on the origins of ham radio aboard Mir on page 32.)

Will Mir Stay in Orbit?

There is considerable opposition in Russia's parliament to plans for de-orbiting the aging Mir space station later this month. According to reports on "Newsline," the lower house of Parliament overwhelmingly approved a resolution condemning the plans and said the $60 million (US) needed to keep the craft in orbit could be found somewhere in the federal budget. Key to the lawmakers' concerns is jobs. They say Mir provides employment for 100,000 scientists and engineers and don't want to see those jobs lost. At press time, there was no word on a final decision.

ARRL Again Looks Toward "Refarming" Novice Bands

The ARRL Board of Directors will revisit the question of "refarming" the HF Novice subbands, now that the FCC has eliminated the Novice license and the number of active Novices is decreasing rapidly as licenses expire and are not renewed. Reassigning these frequencies —and perhaps expanding voice subbands in the process—was part of the ARRL's original restructuring proposal, which was not accepted by the FCC. The League board is not expected to take a position on "refarming" at its meeting in January, but rather to seek out member input on whether and how it should be done.

ARRL to Reconsider Code Stance

Since 1993 it has been ARRL policy to oppose any effort to drop the Morse code as an international licensing requirement for amateur radio. But with national associations around the world deciding the requirement has outlived its usefulness, and with the ARRL casting the sole "no" vote on the at an International Amateur Radio Union Region 3 conference last year, the League's Board of Directors has decided to revisit the issue at its January 2001 meeting. According to the *ARRL Letter,* the board may reaffirm its current position, modify it or seek input from members.

The next time the matter will come up for a vote in an international forum is at an IARU Region 2 conference this coming October, suggesting the League board may be able to wait until its July meeting to make a decision. However, ARRL sources tell *CQ* that position papers on various topics are due by June, so the board may not want to wait that long and possibly lose out on taking the leadership position on the issue in our own IARU region.

2001 Ham Test Fees Rise to $10

The federal government has removed the limitation on amateur radio test fees, and most Volunteer Examiner Coordinators raised their fees on January 1 from $6.65 to $10.00. VECs raising their rates include the ARRL VEC and W5YI VEC, which combined account for the vast majority of test sessions given in the United States each year. According to ARRL/VEC Manager Bart Jahnke, W9JJ, the new fee reflects the fact that VECs are now doing more work for the FCC than when the system was first put into place more than 15 years ago. This includes data entry on applications for new and upgraded licenses, which are now filed electronically by the VECs. Originally, FCC personnel did this work after the VECs collected the forms and forwarded them to the FCC's licensing branch in Gettysburg, Pennsylvania.

FCC Blasts W5YI/VEC

In a scathing letter to W5YI/VEC chief Fred Maia, W5YI, FCC Special Counsel for Amateur Radio Riley Hollingsworth, K4ZDH, cited two instances of forged signatures at license exam sessions in South Carolina as "an alarming failure of oversight and integrity in the Volunteer Examiner program..." and faulted W5YI/VEC for poor supervision.

At the two test sessions, both held in Clemson, South Carolina in the summer of 1999, Hollingsworth said the FCC's investigation found that one or more VE signatures were forged on fourteen exam applications, and that two examiners "apparently awarded themselves upgrades to Extra Class by forging the signatures of other VEs." One of the examiners allegedly involved, William Browning, has forfeited his amateur license, according to Hollingsworth, and "(t)he role of (the other) VE/examinee ... is still under review." The letter also noted that "(t)he VE whose name was forged on the Form 610s, Grady P. Robinson, was not present at the session and was in no way at fault."

The letter asks for W5YI to "provide in detail your procedures for screening, accrediting, and verifying the results of W5YI VEC Volunteer Examiners." It is unclear what, if any, action could be taken against a VEC in this situation, or what a VEC's responsibilities are in terms of protecting against fraud. The FCC rules are silent on the VEC's role once an examiner is accredited.

Crackdown Continues on Uncoordinated Repeaters

The FCC is continuing its offensive against uncoordinated repeaters that reportedly are causing interference to coordinated repeaters. While coordination is not required under FCC rules, the rules do state that in cases of interference between coordinated and uncoordinated repeaters, it is the responsibility of the licensee of the uncoordinated "machine" to take any steps necessary to resolve the problem, including going off the air.

In recent actions, licensees of three apparently uncoordinated repeaters, one

(Continued on page 69)

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Zero Bias

BY RICH MOSESON, W2VU

An Editorial

Rocket Science

The euphoria in late November and early December over the successful launch of AMSAT-OSCAR 40, previously known as Phase 3D, quickly turned to gloom in mid-December as it became apparent that something had gone terribly wrong in attempting to start moving the satellite toward its planned orbit. First, the engine didn't fire on schedule. Then, when it did start, it didn't shut off when it was supposed to. And two days later, while ground controllers were trying to figure out what was wrong with AO-40's propulsion system, the satellite's telemetry beacon went silent (see our "Amateur Satellites" column on page 11 for details).

As we go to press, the status of the satellite is still uncertain. Possibilities range from complete disaster to possible recovery, although the initial recovery effort apparently failed. I say apparently, because the flow of information out of AMSAT has been sporadic at best, and the real news tends to be buried two-thirds of the way down the announcement. Regardless of how this turns out, though, there will be many questions about the wisdom of focusing so much energy on one super-satellite and about the future of AMSAT and the amateur satellite program. It should be remembered that AMSAT got its start after Australis-OSCAR 5 was built and ready to fly, but the original Project OSCAR couldn't arrange a launch. AMSAT—with its location near Washington, DC and contacts in the federal government—managed to get AO-5 launched, and Project OSCAR faded into the ham radio history books.

What's Ahead?

Now the question becomes, "Is this the end of AMSAT?" "Is this the end of the amateur satellite program?" We certainly hope not. There was a comment made in one of the many e-mail exchanges soon after the AO-40 beacon disappeared that we should remember, this *is* rocket science. It is complex, difficult, dangerous, and is still as much art as science. Most rocket scientists would have you believe otherwise—that everything is mathematically based and therefore 100% predictable. If that was the case, there would be no failures. But the fact is that things don't always work the way they're supposed to. Rockets blow up; satellites blow up. Missions to Mars fail because scientists are using two different systems of measurement and nobody notices.

At the base of the whole AO-40 mess was actually a plumbing problem—a sticky valve in a hydraulic system—but you can't exactly send a repairman up to check it out and try to fix it (not unless you're NASA and the satellite is something like the Hubble Space Telescope). Thus, even a plumbing problem becomes a matter of rocket science, and of radio science, trying to remotely control a mechanical device that is hundreds or thousands of miles away, and sometimes not knowing the results of your effort until well after the event has or hasn't taken place.

Should AMSAT fold its tents and fade into the sunset? Absolutely not. Should amateurs who donated huge amounts of time and money to the P3D/AO-40 project feel that their contributions were in vain? Absolutely not. If amateur radio is going to remain relevant in the 21st century, then we must maintain and build on our presence in space. We must learn from our failures, and we must try again.

What will we learn this time? There will be technical lessons, of course, as the engineers and rocket scientists try to figure out exactly what went wrong and why, and to design things differently next time so this particular problem is less likely to recur. We also need to reexamine the wisdom of putting all of our satellite eggs in one basket, and of focusing resources exclusively on a single, massive, and multifaceted satellite over a period of nearly a decade. Perhaps future satellites ought to be less ambitious, less expensive, and thus less of a disaster for the amateur satellite program if they fail. The very fact that it took so long to find a launch for AO-40—effectively putting the amateur satellite program on hold for several years—gives credence to this argument.

There will be other views, of course, and they ought to be debated vigorously. There doesn't have to be only one result, either. Nowhere is it written that there may only be one group of hams dedicated to designing, building, launching, and operating amateur satellites. If there are enough people with divergent views, there is nothing stopping those people from striking out on their own, and nothing wrong with it, either. Coordination and cooperation would be necessities, of course, but if satellite communication is ever going to become a major activity among hams, then eventually there must be more than one group of hams working on more than one satellite project at a time.

In his column this month, *CQ* Satellite Editor Phil Chien, KC4YER, writes about a certain line from a recent episode of the TV show "The West Wing." I had thought about the same line from the same episode. It applies perfectly in this case. The basic message from "the President" is that it's okay to try and fail, as long as you learn from your failures and try again. The message is important for us, too. Whatever really happened up there in space, whatever and whoever was responsible, we must learn from our failures, accept the result, and move forward.

Share and Share Alike

My original plan for this month's editorial was to talk about something unique among hams—our willingness to share our knowledge and our skills not only for the betterment of amateur radio, but to help educate each other one-on-one as well. I cannot count the number of times I've heard people on the air explaining how something works or how to do something, or offering to come over and help. Often, it turns out, the person offering the help is a professional in the field involved and is giving away knowledge and assistance for which one would normally have to pay.

How many times have we all gone to club meetings and heard experts on various topics (ham-related and non-ham related) making presentations—presentations that might command a healthy honorarium at a professional conference or similar gathering? Most hams, however, are perfectly willing to share their professional knowledge with their fellow amateurs for, at most, a free dinner or a club coffee mug.

The same applies to hamfests and ham conventions. Most have expert speakers conducting forums on various topics, forums that are included in your admission price of (generally) $5 to $6 for local shows and $15 to $20 for bigger events. These speakers are not paid. At most, they get a free pass and a close-in parking space. In so many cases, if the same person makes the same basic speech at

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SS-12	10	12	1⅛ x 6 x 9	3.4
SS-18	15	18	1⅛ x 6 x 9	3.6
SS-25	20	25	2⅞ x 7 x 9⅝	4.2
SS-30	25	30	3¾ x 7 x 9⅝	5.0

MODEL SS-25M

DESKTOP SWITCHING POWER SUPPLIES WITH VOLT AND AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-25M*	20	25	2⅞ x 7 x 9⅝	4.2
SS-30M*	25	30	3¾ x 7 x 9⅝	5.0

MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3½ x 19 x 9⅝	6.5
SRM-30	25	30	3½ x 19 x 9⅝	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3½ x 19 x 9⅝	6.5
SRM-30M	25	30	3½ x 19 x 9⅝	7.0

MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3½ x 19 x 9⅝	10.5
SRM-30-2	25	30	3½ x 19 x 9⅝	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3½ x 19 x 9⅝	10.5
SRM-30M-2	25	30	3½ x 19 x 9⅝	11.0

MODEL SS-12SM/GTX

MODEL SS-10EFJ-98

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GE MONOGRAM SERIES & MAXON SM-4000 SERIES
ICOM IC-F11020 & IC-F2020
KENWOOD TK760, 762, 840, 860, 940, 941
KENWOOD TK760H, 762H
MOTOROLA LOW POWER SM50, SM120, & GTX
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SS-18EFJ
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SS-12MC
SS-10MG, SS-12MG
SS-101F, SS-121F
SS-10TK
SS-12TK OR SS-18TK
SS-10SM/GTX
SS-10SM/GTX, SS-12SM/GTX, SS-18SM/GTX
SS-10RA
SS-12RA
SS-18RA
SS-10SMU, SS-12SMU, SS-18SMU
SS-10V, SS-12V, SS-18V

*ICS – Intermittent Communication Service

a professional conference, to the same number of people, he or she will go home with a check for several hundred dollars, plus expenses.

The satellites we have built and launched, the digital networks we've designed and installed, the emergency communications expertise we've learned and in turn teach ... none of these would be possible without the willingness of hams as a group to share their knowledge, skills, and experience without getting paid for it.

I started thinking about this as I was reading through articles submitted for publication in *CQ,* learning from them myself, and thinking how fortunate I am to be able to be the conduit through which our authors can share their knowledge with you. Take, for example, VK6VZ's article in this issue on grey-line communication, as opposed to "dark-line" communication, which I'd never heard of before. He describes an experience that many of us have shared, but without really understanding what was going on, and provides the explanation. Plus, Bob Shrader, W6BNB, offers advice on protecting your shack from fire, but at the same time teaches us some fire science ...

"Flames are gasses whose molecules and atoms are energized to the point that they radiate tiny energy packets called *photons.* Photons developed by flames have frequencies of both light and heat..."

Now be honest here: Have you *ever* thought of flames as energized gasses emitting photons? It puts fire in a whole new light, so to speak. Bob expands on this line of teaching in another article on the essential nature of electricity we'll be getting to in the not-too-distant future. You'll find it fascinating (but you won't find it here this month; it's long and we don't have room, due to the the WPX SSB Contest results).

New Contest Reporting Timetable

Speaking of the CQ World-Wide WPX Contest results, if you're a regular participant in this event, you know to expect the SSB results in our March issue and the CW results in May. Well, the widespread use of computerized logging as well as computerized log-checking has sped up the process of determining the final results. As a result, we are able to bring you the WPX contest results a month earlier than usual—the SSB results this month and the CW results in April. It is our goal to bring you all contest results a month earlier, so if all goes according to plan as the year progresses, you'll have an extra month before the next running of each contest to see how you did and plan your strategy based on past performance.

Finally in the contest department, we have decided to drop the VHF Spring Activity Weekends, which were carried over last year from *CQ VHF.* There was virtually no activity last year... so little, in fact, that there are no meaningful results to report, and no reason to believe that if we just hang on, it might catch on. On the other hand, our revamped summertime CQ World-Wide VHF Contest seems to have been a success, with a great increase in entries over 1999, so keep your eyes open for those results and plan to join us this summer on 6 and 2 meters.

Remember, February is heart month. Give yourself and your loved ones the best possible valentine by getting up out of your seat, losing weight if you need to (and most of us need to), quitting smoking if you're still addicted, and getting regular exercise. Take a handheld with you and talk to your fellow hams while you're out walking or biking. You never know when you might learn something new, and exercise your mind along with your body.

73, Rich, W2VU

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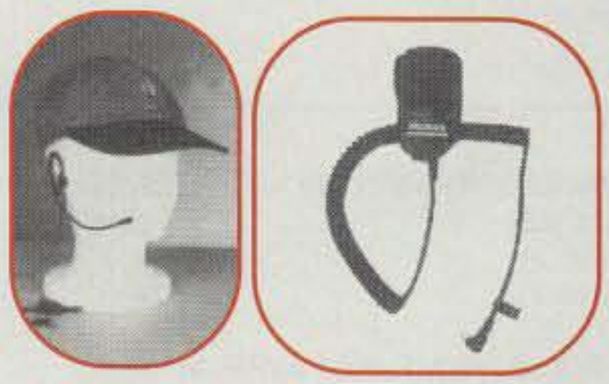

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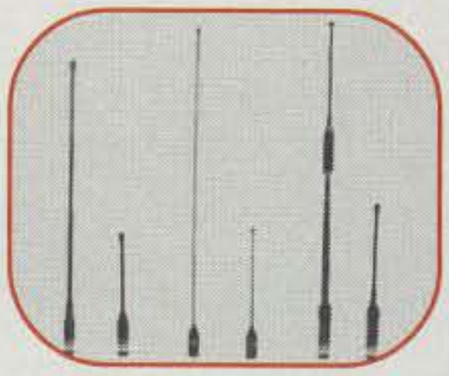

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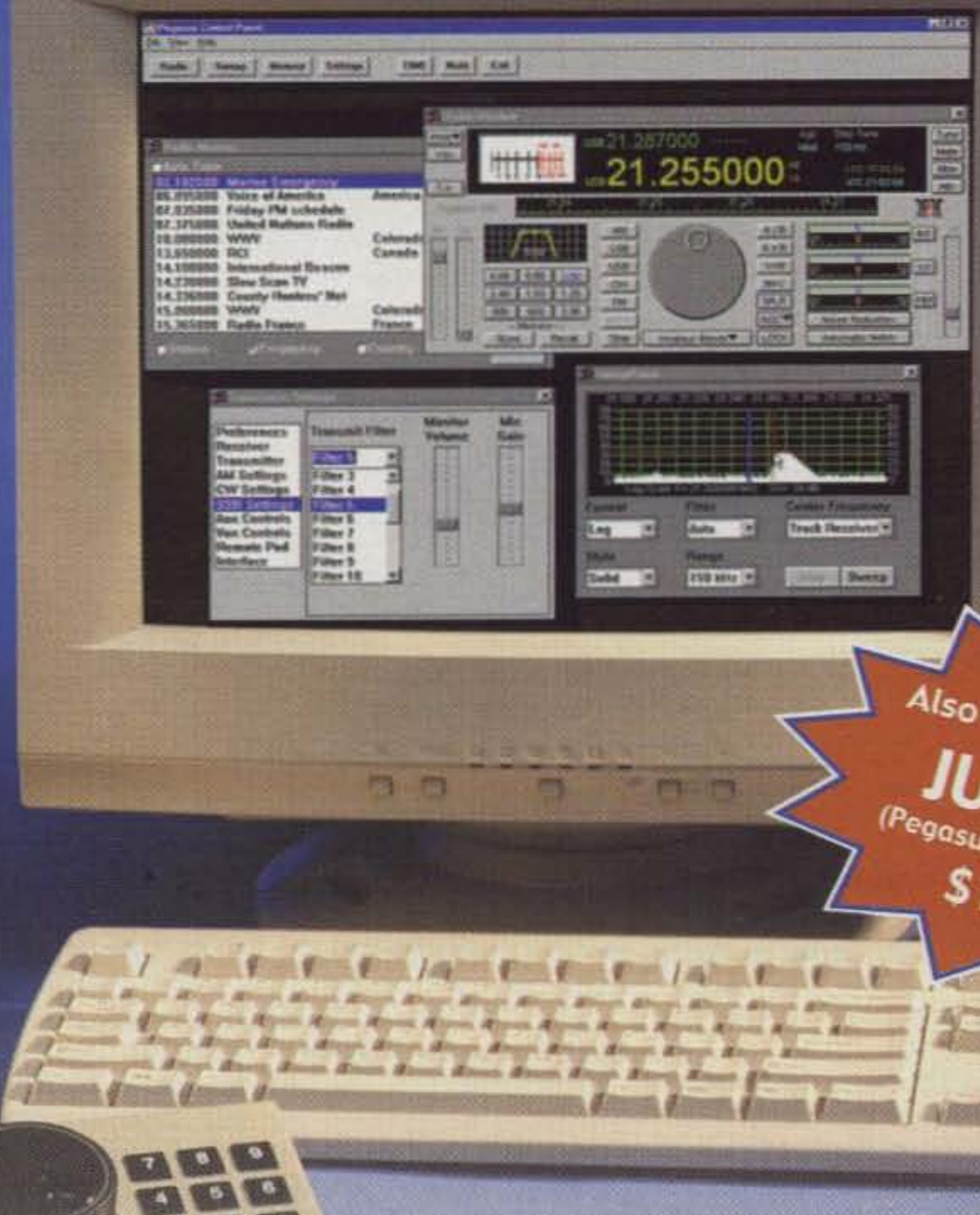

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Announcements

• **FAR Scholarships** – The Foundation for Amateur Radio, Inc., plans to administer 67 scholarships for the academic year 2001-2002. Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled or have been accepted for enrollment at an accredited university, college, or technical school. The awards range fom $500 to $2000. Additional information and an application form may be requested by letter or QSL, postmarked prior to April 30, 2001 from: FAR Scholarships, P.O. Box 831, Riverdale, MD 20738.

• **K4H Special Event** – The Orlando (Florida) Amateur Radio Club, K4H, will be on the air 1400–2100Z February 10 and 1300–2000Z February 11 on 7.275, 14.320, and 21.375 to celebrate 54 years of the Orlando HamCation[sm] Show. QSL special event card will be available from John Melchori, K4JBM, 1840 Cleek St., Orlando, FL 32808.

• **The following hamfests, etc., are scheduled for February:**

Feb. 3, **Hiawatha ARA Swap & Shop,** Negaunee Township Hall, Negaunee, Michigan. For more information, contact John Veiht, N8RSE, 906-228-9417, or Bob Serfas, N8PKN, 906-226-9782, e-mail: <n8pkn@aol.com>. (Talk-in 147.27)

Feb. 4, **Northern Ohio ARS Winterfest 2001**, Gargus Hall, Lorain, Ohio. Contact John Schaaf, K8JWS, 216-696-5709 or NOARS Winterfest, P.O. Box 432, Elyria, OH 44036-0432 (e-mail: <noars@qsl.net>). (Talk-in 146.700– & 444.800+)

Feb. 5, **West Valley ARC Radio Equipment Auction**, St. Clement of Rome Catholic Church Social Hall, Sun City, Arizona. Contact WVARC, P.O. Box 1573, Sun City, AZ 85372 (623-546-5710; e-mail: <ronk6op@juno.com>).

Feb. 9–11, **Orlando HamCation[sm] Show & ARRL North Florida Section Convention**, Central Florida Fairgrounds, Orlando, Florida. Contact Ken Christenson, 5548 C Cinderlane Pky., Orlando, FL 32808 (407-291-2465; e-mail: <af4zi@juno.com>). (Exams, must preregister, Gil Lineberry, 407-843-4122; Talk-in 146.760)

Feb. 10, **Cherryland ARC Swap-n-Shop**, Immaculate Conception Middle School, Traverse City, Michigan. Contact Joe, W8TVT, 231-947-8555, or Chuck, W8SGR, 231-946-5312. (Exams; Talk-in 146.86)

Feb. 10–11, **Dixiefest 2001**, Shelby County Building, Mid-South Fairgrounds, Memphis, Tennessee. Contact 901-372-8031 or 901-365-8088; <www.dixiefest.org>. (Exams Sunday morning)

Feb. 17, **Salem Hamfair**, Polk County Fairgrounds, Rickreall, Oregon. Contact Dick Smith, KK7OX, 541-997-4074; e-mail: <kk7ox@presys.com>; <http://repeater.homepage.com>.

Feb. 17, **Algonquin ARC Fleamarket**, Marlboro Middle School, Marlboro Middle School, Marlboro, Massachusetts. Contact Ann Weldon, KA1PON, 1-508-481-4988 before 9 PM. (Exams 9–11 AM; Talk-in 146.61, 233.94, 449.925)

Feb. 18, **Livonia ARC Swap 'n Shop**, William M. Costick Activities Center, Farmington Hills, Michigan. Contact Neil Coffin, WA8GWL, Livonia ARC, P.O. Box 51532, Livonia, MI 48151 (SASE); 734-261-5486; e-mail: <swap@larc.mi.org>; <www.larc.mi.org>. (Talk-in 144.75/5.35, 146.52)

Feb. 24, **ARA of Southern Tier Winterfest**, NYS National Guard Armory, Horseheads, New York. Contact Barry, 607-737-0626; e-mail: <winterfest@arast.org>; <http://www.arast.org>. (Exams 9 AM; Talk-in 146.70–, 147.36+)

Feb. 24, **Northern Vermont Winter Hamfest & ARRL Vermont State Convention**, Milton High School, Milton, Vermont. Contact W1SJ, 802-879-6589; e-mail: <w1sj@arrl.net>; web: <http://www.ranv.together.com>. (Exams 9 AM and 1 PM; Talk-in 145.15, bulletins 146.67)

Feb. 24, **CDARC Hamfest**, St. Mary's Grade School, Bismarck, North Dakota. Contact Kurt, KBØKDG, e-mail: <carufel@home.com>.

Feb. 24, **LPARC Cabin Fever Hamfest**, La Porte Civic Auditorium, La Porte, Indiana. Contact Neil Straub, WZ9N, P.O. Box 30, La Porte, IN 46352 (219-324-7525; e-mail: <nstraub@niia.net>; web: <www.geocities.com/k9jsi/>. (Talk-in 146.52, 146.61–, PL 131.8)

Feb. 25, **Cuyahoga Falls Hamfest**, Electronic & Computer Show, Emidio's Party Center, Cuyahoga Falls, Ohio. Contact Carl Hervol, 2292 Lake Center St., Uniontown, OH 44685 (330-497-7047; e-mail: <carlh@voyager.net>).

Feb. 25, **Vienna Wireless Society Hamfest**, Annandale Campus, Northern Virginia Community College, Annandale, Virginia. Contact Jim, W4JTP, 703-392-0150; e-mail: <winterfest@att.net>; <http://winterfest.home.att.net>). (Exams Sat., Feb. 24 8 AM; Talk-in 146.31/91)

Feb. 25, **LIMARC Winterfest Electronics Hamfair & Fleamarket**, Levittown Hall, Hicksville, New York. Contact 516-520-9311; <http://www.limarc.org>. (Talk-in 146.850, PL 136.5)

Oops...

Looks like the gremlins in the composing room were hitting the eggnog a little bit early, and we have a couple of typographical "oopses" in the December issue.

First of all, the several references to 218–219 MHz as a secondary amateur allocation in W2VU's review of the ADI AR-247 should all be 219–220 MHz, since that's where the secondary amateur allocation is. And in KD4DSX's article "Amateur Operating in a Commercial Environment," the FCC's new rules on RF exposure to humans went into effect on August 15, 1997, not August 15, 199, as printed. Rules enacted in 199 would most certainly be outdated by now!

In the January issue, the author of "An Underground 'Radio' Transmitter, Circa 1901" is Bill Greene, WA2JHD, not Billi Greene. Sorry, Bill. And in the "Kenwood Connects in Atlanta" article, *CQ* Ad Manager Jon Kummer's callsign is listed as WB2OJK. It's really WA2OJK. Funny, he *looks* like a WB2!

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Amateur Satellites

BY PHILIP CHIEN, KC4YER

Ham Radio in Space

AO-40 Silent, May Be Lost

As we go to press it appears that the AO-40 satellite has had a catastrophic failure. While the satellite apparently is still in one piece, it is not functioning and may be permanently disabled, although there are still a few glimmers of hope. The following information is based on the latest information available at press time and may be out of date by the time you read this column.

It took nine years from the time Phase 3-D was originally conceived until its launch. The launch was one of the most anxiously awaited events for amateur radio operators around the world (sSee "Amateur Satellites," January 2001 *CQ*). Phase 3-D's launch on November 16, 2000 was followed with intense interest by the hundreds of hams and paid engineers who worked many hours to make it possible, as well as by thousands of other amateurs around the world.

Shortly after launch, it was announced that Phase 3-D was renamed AO-40 (AMSAT OSCAR-40). It's traditional to give most amateur satellites OSCAR numeric designations, but only after they've achieved orbit and transmitted on amateur frequencies.

The plan was for AO-40 to turn on its 70 cm beacon three hours after separation from the launch vehicle. However, surprisingly, the beacon heard around the world was the 2 meter beacon on 145.880 MHz, due to a problem with the 70 cm transmitter.

Hundreds of hams commented about how strong the 2 meter beacon was and many reported hearing it on handheld radios with whip antennas. The computer revolution made it extremely easy to decode the data; a $20 sound card with a freeware decoding program could do as good a job as a $400 PSK modem. Going one step further, a handful of hams retransmitted the telemetry via the internet, permitting anyone with internet access the capability to view the telemetry in real-time.

The Heart of the Problem

Even though the malfunctioning 70 cm was troublesome to ground controllers, the real problem—and the possible disaster—didn't begin until it was time to fire the spacecraft's main engine to begin moving toward its planned orbit. Before we talk about what didn't work, let's take a moment to look at the engine itself, its interesting history, and how everything was *supposed* to work.

AO-40's main engine is a MBB 400 Newton (90 pounds-force) engine with a long heritage. The engine was originally designed as a vernier (steering) rocket for the Europa launch vehicle. The design was adapted into an apogee engine and has been used for many European-built communications satellites. Previous units flew on the AO-10 (Phase 3-B) and AO-13 (Phase 3-C) spacecraft.

AO-40's engine was a flight spare from the Galileo project. NASA and the German space agency DARA agreed to share the manufacturing responsibilities and science from the Galileo mission to Jupiter. Germany was responsible for the propulsion system, while NASA built the spacecraft bus (the body of the vehicle). Both countries built scientific instruments and provided scientists to analyze the data. The German propulsion system included small altitude thrusters to change Galileo's orientation and a main engine to put Galileo into orbit around Jupiter. Three engines were built, a flight unit which flew to Jupiter and two ground spares for testing. After the final perijove burn in orbit around Jupiter, the spare engines were declared surplus. MBB donated a testing engine to Phase 3-D.

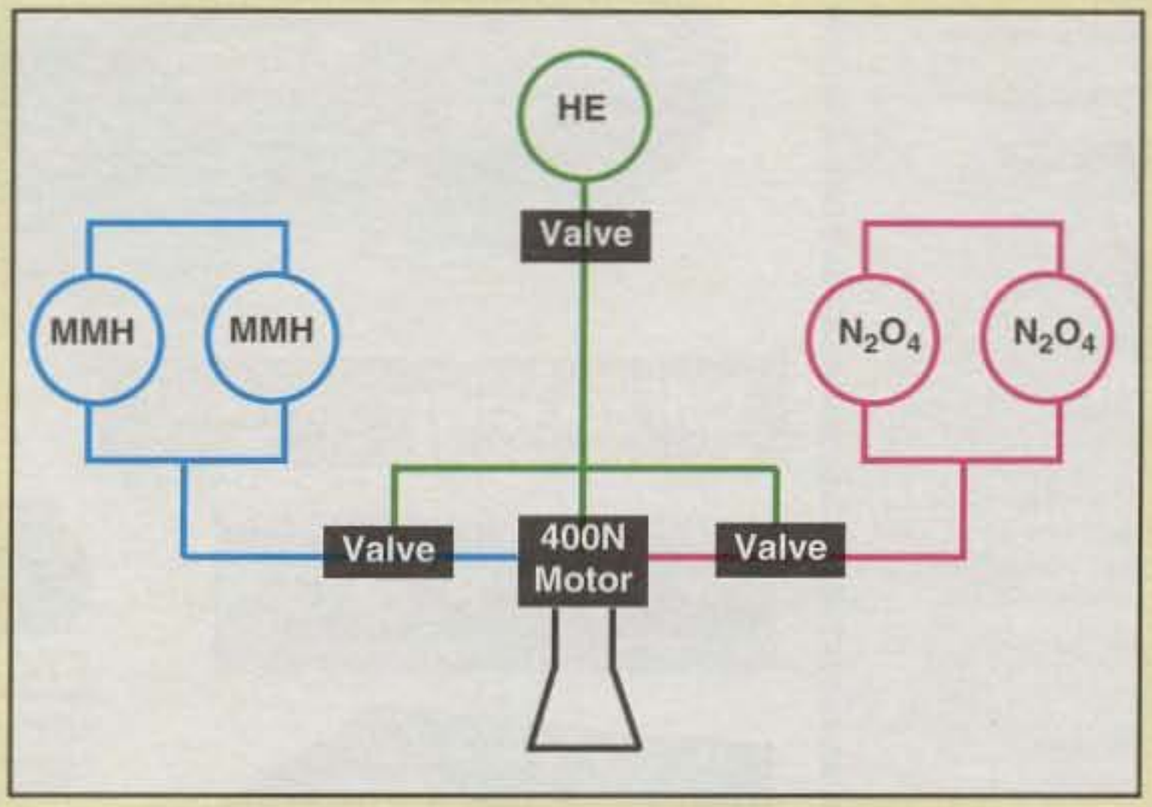

Fig. 1– A very simplified view of AO-40's propulsion system. Helium gas (HE) pressurizes the engine system, allowing control of the valves that regulate the flow of propellants monomethyl hydrazine (MMH), the fuel, and nitrogen tetroxide (N2O4), the oxidizer. These compounds ignite on contact and provide the energy to propel the spacecraft. Obviously, uncontrolled mixing or a leak in the system could prove disastrous. AO-40's initial propulsion problem occurred when the valve controlling the flow of helium gas malfunctioned.

AMSAT volunteer Rick Leon, KA1RHL, holds the AO-40 motor in this prelaunch photo. It's very small, but packs a powerful punch.

Here's how it's supposed to work: The engine uses monomethyl hydrazine (MMH) fuel and nitrogen tetroxide (N_2O_4) oxidizer. These propellants, called "hypergols," ignite on contact without an igniter (think of mixing acid and water, with much more energy). The engine uses pneumatic valves con-

(Continued on page 127)

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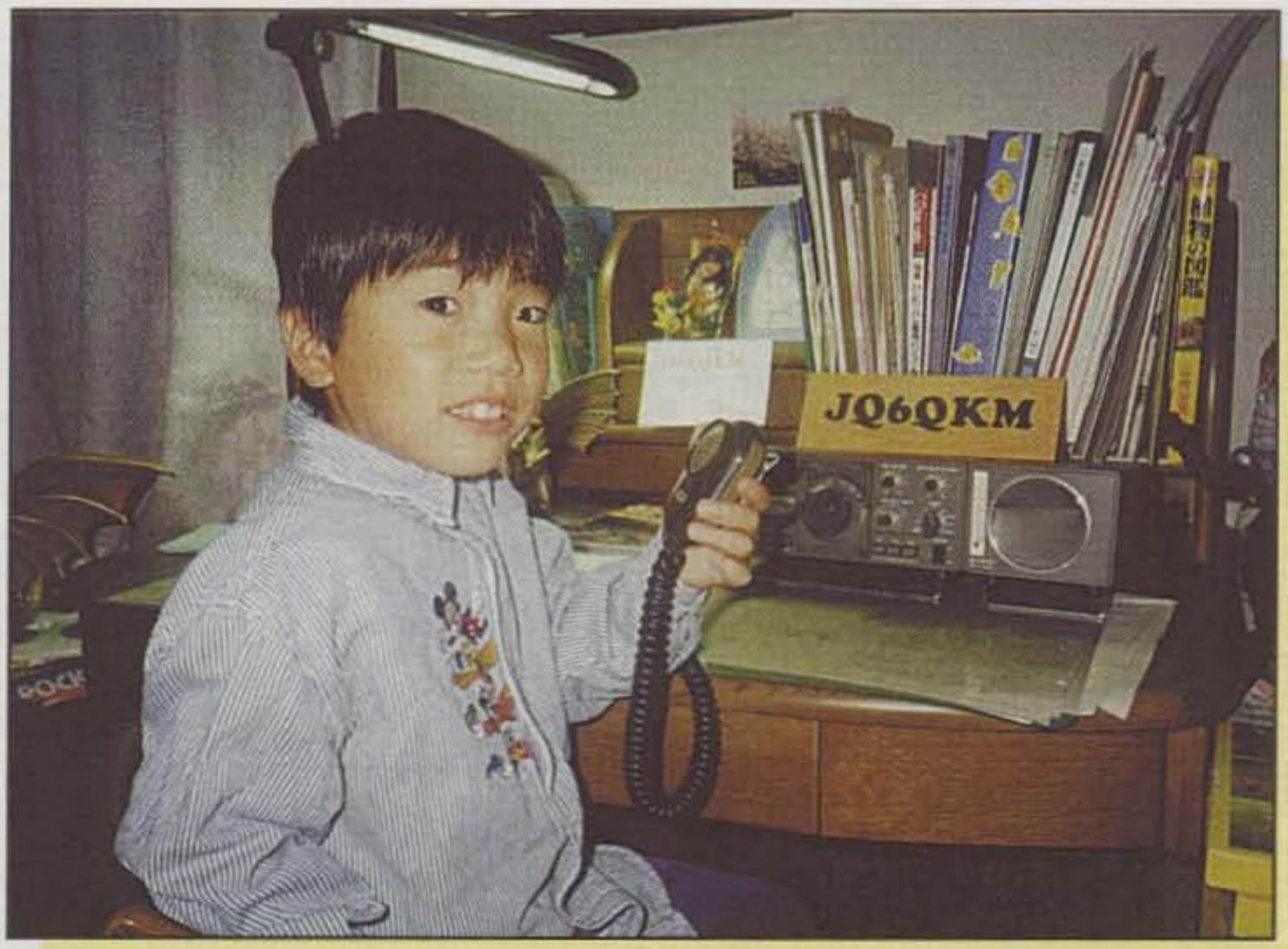
Results of the 2000 CQ WW WPX SSB Contest

BY STEVE BOLIA,* N8BJQ

Absolutely fantastic 10 meter conditions!! This comment by ON4CAS says it very nicely: "Anyone complaining about cycle 23 should have monitored 10 meters during the contest." Ten meter records were broken nearly everywhere, and the band was chock full of signals. Special Y2K prefixes and some exciting expeditions also helped to get the new millennium off to a great start. 2001 promises to be even more exciting.



Perhaps our youngest competitor, this is JQ6QKM operating on 15 meters.

DX

The Single Op All Band title went to 1997 winner P4ØV. Carl had the most Q's and the second highest multiplier total of all single ops. Second place went to Hrane, YT1AD, at 3V8BB, with CT3BX third and HD8Z operated by HC1OT fourth. KQ2M's USA record put him in the fifth spot with Ivo, C4A (5B4ADA/9A3A), sixth, JY9NX (JM1CAX) seventh, Oceania leader NH7A eighth, V31JP ninth, and KE3Q tenth.

Ten meters was the place to be (and I think nearly everyone was there). EA8AH operated by Jaakko, OH1MA, broke ZX5J's 1999 record on the way to number one. Pekka, OH1RY, at TXØDX put in a fantastic effort from Chesterfield Island to take second place. Pekka made over 4700 folks happy with a new DXCC country. If you missed him, you did not look high enough in the band. KP2A operated by KW8N was third with a North American record, followed by KH6ND and 9G5ZW (OK2ZW). Low-power champion J64AS (N9AG) was sixth, with H22H, L2F (LU9FDG), LT1F (LU1FKR), and GM7V (GM4YXI) rounding out the top ten.

VE6JY operated by VE5MX was the15 meter leader. Second place went to 5NØW operated by OK1RK, with VA7CW at VB7B third, KH6TO at AH7DX fourth, and KX8R (K8DX) fifth. Wil, DJ7AA, was the 20 meter champion, with U.S. champ KK9A second, WK4R (K4XS) third, IQ3A (IV3TAN) fourth, and YT1BB fifth. Jiri, OK1RI, led a European sweep of the 40 meter top ten. RW2F (UA2FB) was second, with HG9X (HA9AX) third, UW5Y (UW2YW) fourth, and LY6K fifth. Yuri, VE1BY (K3BU), broke the North American record on his way to the 80 meter title. Second went to YTØA (YU1FW), with HG3M third, U.S. champ W6RJ fourth, and KE1Y right behind in fifth. Top band honors went to S57M, with SP7VC and OZ3SK providing lots of competition. Low Power champ OK2SNX was fourth, with 9AØC (9A2HI) fifth.

Some great scores were turned in by low power entrants this year. This category is getting very competitive, with scores approaching those of many of the top high power entries. With over 1000 low power logs received, this is by far our largest category. SU9ZZ edged out 8P2K for the Single Op All Band title, with VE3EJ third, VP5E (K6HNZ) fourth, and ZX2B (PY2MNL) fifth. Rounding out the top ten were KHØ/KH8KYU, UP5P (UN5PR), U.S. champ AA3E, JL1ARF, and PY2YU.

J64AS operated by N9AG turned in an incredible score from St. Lucia to lead the 10 meter entries. Thanks to Mr. Perry Mason, Scott was able to be the first to use the J64 prefix. L21H finished second, with UA4LCQ third, N4MO at V31RU fourth, and LP1F fifth. VA3MM made good use of his special VC3M call to take 15 meter honors, followed by RU4PL and 4Z8DX (4Z4DX). S58AL turned in the top 20 meter score, followed by S51CK and RJ9J. LX7I edged out S59GMA for 40 meter honors, with YZ1V third. In one of the closest finishes, F5BEG edged out S53F for the top spot on 80. Top band honors went to OK2SNX, who just beat 9AØC (9A2HI).

3V8BB was the Tribander/Single Element champion with over 15M points. In second was JY9NX operated by JM1CAX, with P43E third, VA3UZ fourth, and S5ØK fifth. CW6V operated by CX6VM led the T/S 10 meter entrants, with AM3ATM second and HAØDU third. On 15 meters L99D (LU7DW) used his tribander to make over 2300 Q's. J68TD (KD4YHY) turned in the leading score on 20, with his dad, J68DD (N6JRL), having the top score on 40 meters. PAØMIR and OH3BU topped the 80 and 160 meter categories.

There appears to be a pretty good crop of new operators joining the contesting ranks. CT9KN turned in a fine 5M point effort to take Rookie honors. Not far behind was SL3A (SM3WMV). In third was TF8GX, followed by U.S. leader KT1O and V73UX. UA9JMB, PY2KDX,

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WORLD TOP SCORES

SINGLE OPERATOR ALL BAND

P4$SV	**16,638,841**
3V8BB (YT1AD)	**15,266,880**
CT3BX	14,185,305
HD8Z (HC1OT)	**12,534,148**
KQ2M	**11,875,240**
C4A (5B4ADA/9A3A)	11,745,600
JY9NX (JM1CAX)	11,000,096
NH7A	**10,602,210**
V31JP (K8JP)	10,319,660
KE3Q	10,092,018
JH7PKU	**10,011,300**
P43E	9,968,154
V47KP	9,921,683
*SU9ZZ	9,809,304
WW2Y (N2NT)	9,797,562
NB1B	9,568,953
*8P2K	9,473,783
IR2W	**9,162,675**
VA3UZ	9,026,416
WB9Z	8,893,312

28 MHz

EA8AH (OH1MA)	**14,567,148**
TX$$DX (OH1RY)	**12,049,422**
KP2A (KW8N)	11,385,710
KH6ND	**11,142,754**
9G5ZW (OK2ZW)	10,954,800
***J64AS (N9AG)**	**9,449,193**
H22H (5B4MF)	9,092,146
L2F (LU9FDG)	8,861,904
LT1F (LU1FKR)	8,549,002
GM7V (GM4YXI)	8,305,756

21 MHz

VE6JY (VE5MX)	8,822,016
5N0W (OK1RK)	8,122,044
VB7B (VA7CW)	7,930,930
AH7DX (KH6TO)	7,645,990
KX8R (K8DX)	**7,556,250**
CQ1BOP	6,989,997
S56M	6,151,317
L99D (LU7DW)	5,892,976
SP7GIQ	5,682,285
K3CR (KB3AFT)	5,576,375

14 MHz

DJ7AA	7,955,224
KK9A	**6,621,446**
WK4R (K4XS)	6,442,491
IQ3A (IV3TAN)	6,279,179
YT1BB	5,813,342
5B4LP	5,263,200
S53M	3,782,415
OD5/OK1MU	3,546,108
OH8L (OH8LQ)	3,362,712
*S58AL	3,250,522

7 MHz

OK1RI	**4,079,256**
RW2F (UA2FB)	3,439,494
HG9X (HA9AX)	2,541,605
UW5Y (US2YW)	1,061,214
LY6K	827,640
9A4X	796,572
*LX7I	499,106
*S59GMA	422,037
YL2GD	401,320
LY3BX	399,105

3.7 MHz

VE1BY (K3BU)	2,226,300
YT0A (YU1FW)	1,527,608
HG3M (HA3MY)	1,426,355
W6RJ	**938,352**
KE1Y	921,930
4N1A (YT1DX)	856,975
AN2CRG	416,223
IQ3X (IV3SKB)	396,836
AH6OZ	392,175
*F5BEG	376,671

1.8 MHz

S57M	282,382
SP7VC	225,018
OZ3SK	180,708
*OK2SNX	79,870
*9A0C (9A2HI)	70,518
UR6QA	69,762
LA6WEA	58,098
AA4MM	56,448
*EM6M (UT5MB)	48,800
*WI0WA (W0ETC)	39,125

LOW POWER ALL BAND

SU9ZZ	**9,809,304**
8P2K	9,473,783
VE3EJ	**8,811,015**
VP5E (K6HNZ)	7,071,084
ZX2B (PY2MNL)	5,543,838
KH0/JH8KYU	5,453,832
UP5P (UN5PR)	5,406,314
AA3E (W3CF)	**5,028,426**
JL1ARF	3,833,150
PY2YU	3,818,388
C6AJZ (WI9WI)	3,404,146
WD5K	3,323,214
J6/K5ZM	3,322,008
3B8MM (DL6UAA)	3,245,999
LO7H (LU7HN)	3,191,209
AC0W	2,988,441
AY0N (LU2NI)	2,979,264
VE5SF	2,877,685
HA0IT	2,825,900
RA0FF	2,818,102

28 MHz

J64AS (N9AG)	**9,449,193**
L21H	4,018,443
UA4LCQ	3,904,312
V31RU (N4MO)	3,614,910
LP1F	3,551,646
ZY4K (PY4BK)	3,359,242
LU3HIP	3,358,016
JA7BEW	3,240,334
VC7A (VE7SV)	3,154,950
WE1USA	3,134,799

21 MHz

VC3M (VA3MM)	5,365,405
RU4PL	4,223,076
4Z8DX (4Z4DX)	3,492,918
S58N	2,255,825
RZ9UC	2,240,100
5C8A	2,153,388
S57IIO	1,968,935
JG7PSJ	1,967,458
J68ID (W8QID)	1,738,716
LP7H (LU9HS)	1,674,414

14 MHz

S58AL	3,250,522
S51CK	2,505,048
RJ9J	2,443,920
9E1C (IV3OWC)	1,785,525
M5ACC	1,734,202
J68TD (KD4YHY)	1,368,954
IT9ICS	1,320,660
YU1HFG	1,164,312
DK0NDR (DL8GCS)	633,600
UA3BL	591,690

7 MHz

LX7I	499,106
S59GMA	422,037
YZ1V	274,344
T91AAW (T98R)	245,116
S54A	209,088
HA/YT7BR	78,352
RA9JP	70,596
JA1KVT	20,992
KU6T	17,982
J68DD (N6JRL)	17,380

3.7 MHz

F5BEG	**376,671**
S53F	361,900
EW8DX	243,810
RW3DU	174,000
OK1SI	159,808
YO6BZL	122,007
PA0MIR	101,556
KX9DX	81,829
T95MOJ	80,842
OK1ZMS	64,428

1.8 MHz

OK2SNX	79,870
9A0C (9A2HI)	70,518
EM6M (UT5MB)	48,800
WI0WA (W0ETC)	39,125
VY2MGY/3	30,825

TRIBANDER/ SINGLE ELEMENT ALL BAND

3V8BB (YT1AD)	A	15,266,880
JY9NX (JM1CAX)	A	11,000,096
P43E	A	9,968,154
VA3UZ	A	9,026,416
S50K	A	8,321,280
VP6BR (OH2BR)	A	8,085,063
K6LL/7	A	7,226,691
OE4A (OE1EMS)	A	7,216,733
5P1ER (TF3CW)	A	6,117,648
KZ5D	A	5,736,192
CW6V (CX6VM)	28	6,383,080
AM3ATM	28	4,250,834
HA0DU	28	4,134,026
DK2OY	28	1,506,978
*WG1Z	28	1,134,159
L99D (LU7DW)	21	5,892,976
*VE3MQW	21	516,800
*WA1FCN	21	480,000
*J68TD (KD4YHY)	14	1,368,954
N9HCA	14	967,500
*J68DD (N6JRL)	7	17,380
*PA0MIR	3.7	101,556
OH3BU	1.8	9,372

BAND RESTRICTED

*JA5EO	A	1,162,130
*EF3AGC	A	1,139,401
*JA0BMS/1	A	742,560
*UA3LHL	A	567,240
*S57LWG	A	519,153
*YY5OIA	28	1,298,860
*N4SEA/T	28	801,614
LW8EXF	28	605,642
*N0OFR	28	475,750
*VA7DP	28	282,960
*EC4AGQ	21	70,670
*EF3PL (EC3CMT)	21	12,710

ROOKIE

CT9KN	A	5,315,912
SL3A (SM3WMV)	A	4,557,000
TF8GX	A	2,564,290
KT1O	A	2,186,484
V73UX	A	1,756,664
SM6WQB	A	1,455,664
*KX1X	A	1,298,345
*UA9JLZ	A	1,196,415
*VK2CA	A	1,060,409
F5UTN	A	707,544
*UA9JMB	28	1,096,488
*PY2KDX	28	830,250
F5AOV	28	600,780
*UA9JPK	28	471,099
*F8CNR	28	253,328
*4N1N (4N1JA)	21	575,706
*KD7EJC	14	136

ASSISTED

TM2V (F6GLH)	A	8,927,864
JH4UYB	A	8,235,790
W8EX (N8BJQ)	A	6,521,204
*VA3DX	A	5,935,776
N4WW	A	5,418,491
K3WW	A	5,195,134
UT5UGR	A	4,509,006
SP9QMP	A	3,213,768
WN9O	A	3,000,672
NO2R	A	2,919,036
AN5BM	A	2,751,435
S50L (S53EA)	A	2,386,724
*YU1NR	A	2,230,266
OH9W (OH6EI)	A	2,215,774
EA7DHP	A	2,036,480
4X2T (4X6TT)	28	7,115,488
IO2L (IK2QEI)	28	4,511,880
JR5JAQ	28	4,018,682
K2XR (VE3XAP)	28	2,339,964
S50A	28	2,168,943
OM8A (OM3RM)	21	4,813,784
OH6NIO	21	2,618,982
IU9S (IT9BLB)	14	3,491,972
KD4RH	7	71,043
YU1UO	3.7	329,412
AA1BU	1.8	51,408
W2MF	1.8	51,375
*YU1RA	1.8	27,664

QRP/p

KR2Q	**A**	**2,688,158**
KP4FP	A	2,352,180
NX7K	**A**	**2,025,510**
VE3KZ	A	1,265,841
YU1KN	A	1,086,085
LY10BA (LY3BA)	A	1,080,000

HA5BSW	A	1,075,611
8S5W (SM5IMO)	A	930,230
N0KE	A	879,592
SM3C (SM5CCT)	A	819,970
JA5GPJ	28	755,478
FB1BON	28	687,360
SP3LWP	28	466,926
JR4DAH	28	454,545
LY2FE	28	424,180
CT1ETE	21	498,225
NA4CW	21	409,952
JH1HRJ	21	351,946
4N1DX	21	296,184
DL8TWA (K3TW)	21	118,810
6G0V (XE2Z)	14	1,045,476
UA9AAZ	14	345,300
YO4GHW	14	98,340
W6QU	7	12,420
SP4GFG	3.7	78,657
OK1GW	3.7	63,428
US7MQ	1.8	8,382

MULTI-OPERATOR SINGLE TRANSMITTER

PT0F	21,776,546
VP5V	21,623,154
WP2Z	16,991,818
TM1C	16,768,719
FM5BH	16,010,456
CQ9K	15,265,972
GX6YB	14,475,669
YL4U	14,099,041
IY4W	13,886,082
OH0Z	13,675,615
UP0L	13,023,592
9A7A	12,773,472
VE6SV	12,618,132
S50S	12,506,826
OH2U	11,859,170
OT0C	11,796,375
W6XR	**11,231,169**
YM3LZ	11,206,800
VA3MG	10,862,395
OF3F	10,786,717

MULTI-OPERATOR MULTI-TRANSMITTER

P3A	53,554,592
ZX5J	46,550,452
9AY2K	42,477,343
OT0A	42,191,136
WL7E	**42,013,215**
4O0A	37,780,209
KL7RA	34,835,360
S52Z	32,802,594
4M4X	31,631,529
KM3T	29,338,460
KT8X	26,642,082
RU1A	26,094,584
A61AJ	25,980,511
NR6O	25,106,150
HG6Y	24,365,425
ES5Q	21,522,480
LY7A	21,433,608
W4MYA	21,302,088
NQ4I	20,491,481
AN4URE	19,796,634

** Low power*

and F5AOV topped the 10 meter Rookies, with 4N1N (4N1JA) finishing as the top 15 meter Rookie. Look for great things from these guys in the future.

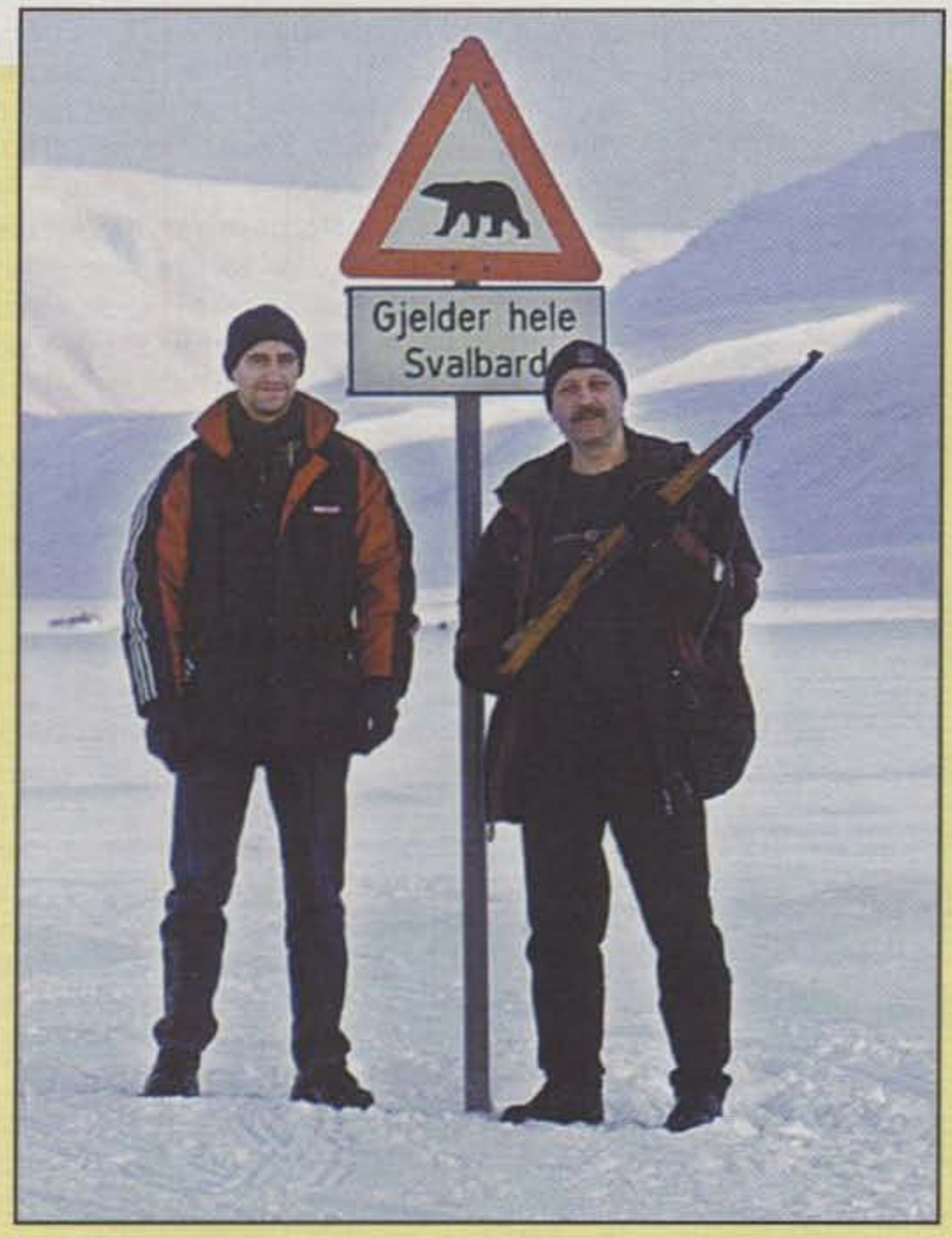
TM2V (F6GLH) repeated as the Single Op Assisted winner. JH4UYB was very close behind in second, with W8EX (N8BJQ) third, LP champion VA3DX fourth, and N4WW fifth. 4X2T (4X6TT) topped the 10 meter Assisted box, followed by IO2L (IK2QEI) and JR5JAQ. OM8A (OM3RM) was the 15 meter leader, IU9S (IT9BLB) the 20 meter winner, and KD4RH leading on 40. On 80 meters, YU1UO won and AA1BU edged out W2MF for top band honors.

KR2Q broke his own U.S. record on his way to win in the QRP category. Doug had plenty of competition from KP4FP and NX7K. VE3KZ and YU1KN rounded out the top five. JA5GPJ edged out FB1BON for the 10 meter title, CT1ETE and NA4CW were one and two on 15, and 6G0V (XE2Z) was the 20 meter champion. W6QU, SP4GFG, and US7MQ were the champs on 40, 80, and 160.

USA

KQ2M did it again!! Bob continued his WPX domination with another U.S. record-setting performance and a World #5 finish. KE3Q was second, with N2NT at WW2Y third, NB1B fourth, and WB9Z fifth. Overall U.S. scores were up a bit from 1999, with six country records broken and all of the top ten breaking 8 million points.

NY4A (W4ZV) edged out KZ5MM for U.S. 10 meter honors and the U.S. record. WW4RR (K4WX) was right on their heels, as was KC3R (WA3FET) and K5RX. KX8R's top score on 15 meters was also good for a U.S. record for K8DX. K3CR (KB3AFT) and K9NW were second and third. Not to be outdone, KK9A broke the 20 meter record in his battle with WK4R (K4XS) for the 20 meter title. KU6T and N8LIQ took the top two spots on 40



This is Stefano, IK2QEI, who finished first in Europe and second in the world on 10 meters Assisted.

← *This is how you hunt for multipliers at JW8G.*

meters. On 80 meters W6RJ and KE1Y from opposite coasts finished less than 20K apart, with Bob coming out on top. AA4MM was the top band champion, followed by WIØWA (WØETC).

AA3E operated by W3CF was the Low Power champion, with WD5K second, ACØW third, N1WR fourth, and KG2AU finishing fifth. WE1USA turned in the top Low Power 10 meter score with a fine 3.1M point effort. Second went to WG1Z with NN9K third. AE1B had the top 15 meter score. NN5Z (K5PX) edged out NP4IW/WX6 for 20 meter honors, KU6T topped N8LIQ for the 40 meter title, and KX9DX and WIØWA (WØETC) won 80 and 160, respectively.

K6LL/7 topped 7 million points to take the Tribander/Single Element title. KZ5D was second, followed closely by N4PN, W1CU, and N1EU. WG1Z, WA1FCN, and N9HCA had the top T/S single band scores on 10, 15, and 20 meters. KT1O had the top Rookie score, with KX1X also turning in a top score.

W8EX (N8BJQ) led the Single Op Assisted category (that probably won't happen again). N4WW was second, with Single Op Assisted veteran K3WW third, WN9O fourth, and NO2R fifth. VE3XAP at K2XR turned in a very nice 10 meter score, as did KO4MR in second place. KD4RH was the 40 meter winner, and AA1BU and W2MF were neck and neck on top band.

KR2Q raised the U.S. QRP standard by a bit with his record-breaking effort. NX7K gave Doug a challenge with his fine effort. NØKE was third, KB3TS fourth, and WZ2T fifth. WA6FGV had the top 10 meter QRP score, as did NA4CW on 15 meters. W6CN, W6QU, and W8QZA/6 led on 20 through 80.

Multi-Ops

The Multi-Operator category also had its share of records broken, with five continental and one U.S. record falling. In a very close race the crew at PTØF (PY5CC, N5FA, and PYØFF) edged out W5AO and K5TT at VP5V for the World Multi-Single title. The margin of victory was less than 200K. Finishing third were W6XK, N6DE, and W7MH at WP2Z, followed by EU record holder TM1C and FM5BH. W6XR and N2AU led W6XR to the top spot in the U.S., with N2GA and K2DO at WV2LI in second, and the crew at AA5NT (AA5NT, WD5FLK, W5WW, N5EE, WJ1U, KC5LBE, N5TVL, KC5WBU, and N5NJ) third. N3OC and AA4NC rounded out the top five.

The multi-national crew at P3A topped the Multi-Multi box with a new Asian M/M record. Second went to ZX5J with a South American record score, with European record holder 9AY2K third, OTØA fourth, and North American record holder WL7E in fifth. The U.S. Multi-Multi race was very interesting, with KM3T turning in a record-setting 29.3M point effort. KT8X was second, with NR6O third, W4MYA fourth, and NQ4I fifth. The top five all topped 20 million points.

The Rest of the Story

You should be reading this a month earlier than in previous years. Our goal is to reduce the turnaround time between the contest and publishing the results. We've taken one step this year and hope to do better in the coming years. To accomplish this, we will need your cooperation. Over two thirds of the logs received for this contest came either on a disk or via e-mail. While 100 percent electronic submission is not yet possible, the more logs we can get electronically, and in the proper format, the quicker we can get them processed and publish the results. If you check the 2001 rules, you will notice that the log submission deadline has been shortened by 10 days on each mode. **The deadlines are now 1 May for SSB and 1 July for CW.** See the rules on the *CQ* website for details.

CABRILLO is the preferred format for electronic logs in 2001, and most of the logging programs will now support this format. Please fill out the header information completely, as it is now your summary sheet. If you can't submit a CABRILLO file, please send an ASCII file showing

TROPHY WINNERS

SINGLE OPERATOR, ALL BAND

WORLD: Stanley Cohen, WD8QDQ Trophy. Won by **P4ØV operated by Carl Cook, AI6V.**
World Low Power: Steve Bolia, N8BJQ Trophy. Won by: **Jaro, SU9ZZ**
USA: Atilano de Oms, PY5EG Trophy. Won by: **Bob Shohet, KQ2M.**
USA Low Power: Oklahoma DX Association Trophy. Won by: **AA3E operated by Doug Priest,W3CF.**
AFRICA: Peter Sprengel, PY5CC Trophy. Won by: **3V8BB operated by Hranislav Milosevic, YT1AD**
EUROPE: Jim Hoffman, N5FA Trophy. Won by: **IR2W operated by Giorgio Beretta, I2VXJ.**
SOUTH AMERICA: Ron Moorefield, W8ILC Trophy. Won by: **HD8Z operated by Pedro Katz, HC1OT.**
CANADA Low Power: Amateur Radio League of Alberta Award. Won by **John Sluymer, VE3EJ.**
OCEANIA: Philip Fraizer, K6ZM Memorial. Won by: **Al Crespo, NH7A.**
***JAPAN**: The DX Family Foundation Trophy. Won by: **Takeshi Kinsho, JH7PKU.**
WORLD QRP/p: Dayton Amateur Radio Association Trophy. Won by: **Doug Zwiebel, KR2Q.**
USA QRP/p: Doug Zwiebel, KR2Q Trophy. Won by: **Wayne Bailey, NX7K.**

SINGLE OPERATOR, SINGLE BAND

WORLD: John N. Reichert, N4RV Trophy. Won by: **EA8AH operated by Jaako Silanto, OH1MA (28 MHz).**
WORLD 28 MHz: Alan Dorhoffer, K2EEK Memorial Trophy. Won by : **TXØDX operated by Pekka Kolehmainen, OH1RY.**
WORLD 7 MHz: William D. Johnson, KVØQ Trophy. Won by: **Jiri Sanda, OK1RI**.
WORLD 3.7 MHz Low Power: Nilay & Berkin Aydogmus, TA3YJ & TA3J Trophy. Won by: **Gerard Gendron, F5BEG.**
OCEANIA: D. Craig Boyer, AH9B Trophy. Won by: **Michael Gibson, KH6ND (28 MHz).**
USA 3.7 MHz: Lance Johnson Engineering Trophy. Won by: **Bob Ferrero, W6RJ.**
USA - 14 MHz Low Power: Boomer Contest Club Trophy. Won by: **NN5Z operated by Bruce Burnette, K5PX.**
USA 21 MHz: Bernie Welch, W8IMZ Memorial. Won by: **KX8R operated by Scott Detloff, K8DX.**
USA 28 MHz Novice/Tech: Jon Engelhardt, KAØZFX. Won by: **Larry Fravel, N4SEA/T.**

MULTI-OPERATOR, SINGLE TRANSMITTER

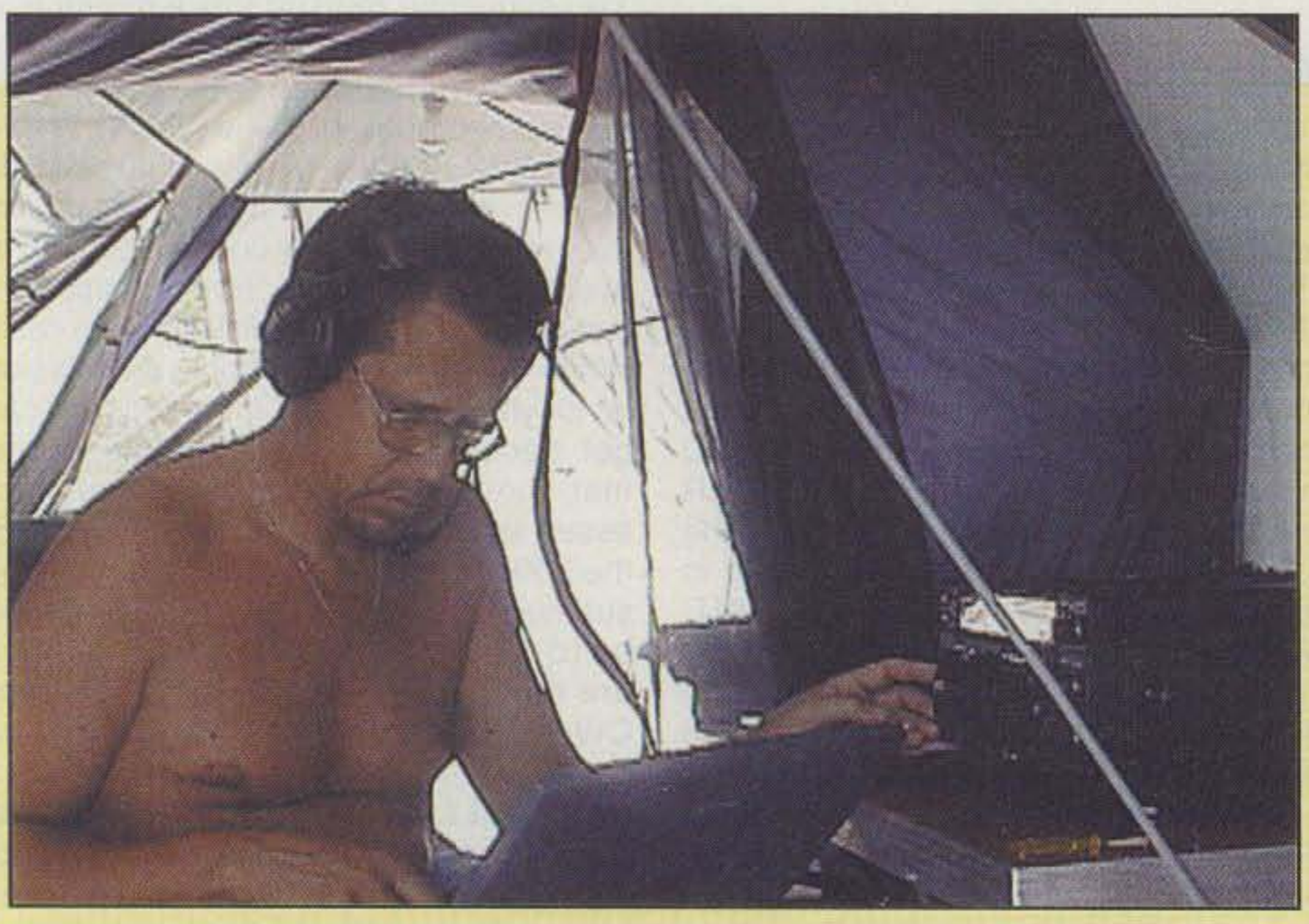
USA: Oklahoma Comm Center Trophy. Won by: **W6XR operated by W6XR & N2AU**.

MULTI-OPERATOR, MULTI-TRANSMITTER

NORTH AMERICA: Burt Curwen, KL7IRT Memorial (James Dixon, NL7HI sponsor). Won by: **WL7E operated by WL7E, KL2A, KL9A, KL7FH, WA2GO, NL7Z, NL7RT, KL7CC.**

CONTEST EXPEDITION

WORLD: Kansas City DX Club Trophy. Won by: **J64AS operated by Scott Lehman, N9AG.**



Pekka, OH1RY at TXØDX, was second in the world on 10 meters and a new country for all.

all required information (DATE, TIME, BAND, CALL, and SENT & RECEIVED exchanges). If you send the ASCII file, a separate summary sheet is required. Check the WPX website for more details on electronic logs. **Remember, if you use a computer to log, or to prepare your log after the contest, a disk or electronic file is required. Failure to do so could result in reclassification as a check log.**

Nearly 1600 logs (5100 band logs) made it into the database this year. Over 75,000 calls appear, with 43,000+ appearing as "UNIQUES" (worked by only one person), and some of them were very unique!! Watch your typing. Lots of apparent typos show up and they will cost you points.

There is one other change to the WPX rules for 2001. **The Multi-Single rules have been changed to allow a second station to hunt for multipliers only on a separate band.** The rules are the same as those for the CQ WW DX contest. Most of the current software already supports this, so no software upgrades should be required. See the current WPX rules for details and watch your 10-minute times.

After each contest (WPX, CQ WW, ARRL, etc.,) there is much traffic on the various reflectors and e-mail directed to the various contest committees about suspected rules violations, some founded and some not. Each contest has rules to follow and they are generally pretty specific. Some violations are fairly easily checked and can be dealt with by the various contest committees. Others, such as excessive power or operation on more than one band, are somewhat more difficult to enforce. The use of high power while claiming low power, or QRP, is quite difficult for the committees to address. If you just have to run more power than you claim, and can live with yourself and your fellow contesters for doing so, then there is not much I can do to stop you. I would love to put on my WPX police badge and show up at your front door to do a spot check, but my wife has cut my travel budget for 2001 to virtually nothing. If you do use packet while claiming Unassisted, there is a pretty good chance that you will get caught. The same goes for self-spotting yourself while claiming to be Unassisted or even Assisted. It's not fair to log on to one of the telnet clusters and spot yourself. According to WPX rules, and many othe contests' rules, the use of packet is passive (receiving and posting spots only). Self-spotting is advertising for Q's and could get you disqualified. If you are one of the growing number of SO2R operators, remember that you can't be CQing on two bands at the same time. You never know who may be listening. Enough preaching for this year!

The 2000 contest was a prefix hunter's dream. Several of the Y2K prefixes were

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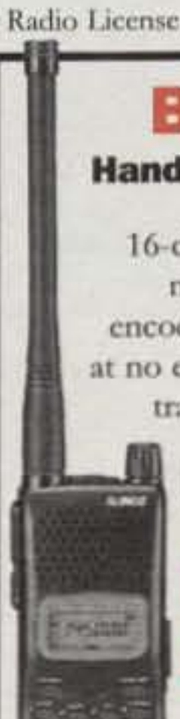

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USA TOP SCORES

SINGLE OPERATOR ALL BAND

KQ2M		**11,875,240**
KE3Q		10,092,018
WW2Y (N2NT)		9,797,562
NB1B		9,568,953
WB9Z		8,893,312
KZ6D (W6NL)		8,538,300
KR1G		8,498,492
K3ZO		8,480,399
KZ4XX (K4JNY)		8,401,272
K5TR		8,329,828
K1TTT (N9KAU)		7,773,822
NV4X (K4MA)		7,529,136
K6LL/7		7,226,691
K7RI		6,830,340
KZ5D		5,736,192
N4PN		5,611,998
W1CU		5,171,166
***AA3E (W3CF)**		**5,028,426**
K5ZO		4,959,318
N1EU		4,586,296

28 MHz

NY4A (W4ZV)		6,006,573
KZ5MM		5,846,792
WW4RR (K4WX)		5,782,980
KC3R (WA3FET)		5,647,638
K5RX		5,441,294
NJ4U		5,438,784
KV4T		5,308,820
KVØQ		4,735,980
KG9X		4,053,600
WO4O (KØEJ)		3,978,000

21 MHz

KX8R (K8DX)		**7,556,250**
K3CR (KB3AFT)		5,576,375
K9NW		4,347,252
AD7J (W7FP)		2,526,810
W6NK		1,268,031

14 MHz

KK9A		6,621,446
WK4R (K4XS)		6,442,491
WY6K		1,808,381
WU3V/5 (W5WMU)		1,311,570
N9HCA		967,500

7 MHz

*KU6T		17,982
*N8LIQ		15,232

3.7 MHz

W6RJ		**938,352**
KE1Y		921,930
NØAH		272,816
*KX9DX		81,829
W5FO		59,860

1.8 MHz

AA4MM		56,448
*WIØWA (WØETC)		39,125
KØCS		11,692
W6VNR		1,980

LOW POWER ALL BAND

AA3E (W3CF)		**5,028,426**
WD5K		3,323,214
ACØW		2,988,441
N1WR		2,451,735
KG2AU		1,972,000
AA1EY		1,927,843
WS1A		1,787,722
WS7V		1,704,678
W7YAQ		1,613,008
N4IG		1,487,490
W2GG		1,464,272
AA6PW		1,462,731
KO4MM		1,448,966
NR6R (K6AM)		1,426,918
N8CN		1,425,375

28 MHz

WE1USA		3,134,799
WG1Z		1,134,159
NN9K		829,545
N4SEA/T		**801,614**
W2BZR/3/T		559,398
K2CS		497,130
NØOFR		475,750
N9GUN		454,494
KG7EW		302,603
N1FUS		270,772

21 MHz

AE1B		1,215,459
WA1FCN		480,000
KW2O (KS2G)		360,696
W6YJ		326,625
AD7U		82,877

14 MHz

NN5Z (K5PX)		129,285
NP4IW/WX6		103,140
WR6WR		68,747
W4TDB		12,308
AB7RW		8,968

7 MHz

KU6T		17,982
N8LIQ		15,232

3.7 MHz

KX9DX		81,829

1.8 MHz

WIØWA (WØETC)		39,125

TRIBANDER/SINGLE ELEMENT ALL BAND

K6LL/7	A	7,226,691
KZ5D	A	5,736,192
N4PN	A	5,611,998
W1CU	A	5,171,166
N1EU	A	4,586,296
ND8DX	A	4,477,815
KE9NA	A	4,155,200
WA7EQW	A	4,152,720
*WD5K	A	3,323,214
NT1N	A	3,067,792
*WG1Z	28	1,134,159
KØCAT (K9WIE)	28	860,292
*WA1FCN	21	480,000
*W6YJ	21	326,625
N9HCA	14	967,500
*WR6WR	14	68,747

ROOKIE

KT1O	A	2,186,484
*KX1X	A	1,298,345
*KG4BIG	A	499,008
*KC8HWV	A	239,400
*KI8IZ	A	158,050
*AC5SU	28	157,542
*KC8MNO	28	137,292
*KD7EJC	14	136

ASSISTED

W8EX (N8BJQ)	A	6,521,204
N4WW	A	5,418,491
K3WW	A	5,195,134
WN9O	A	3,000,672
NO2R	A	2,919,036
N1NQD	A	2,023,584
N5ER	A	1,510,710
N2WKS	A	1,024,254
KF3P	A	1,015,266
KB9MDL	A	1,004,000
K2XR (VE3XAP)	28	2,339,964
KO4MR	28	1,763,850
KD4RH	7	71,043
AA1BU	1.8	51,408
W2MF	1.8	51,375

QRP/p

KR2Q	**A**	**2,688,158**
NX7K	**A**	**2,025,510**
NØKE	A	879,592
KB3TS	A	620,135
WZ2T	A	280,704
WA6FGV	28	164,032
W7/JR1NKN	28	70,950
N2JNZ	28	64,960
NA4CW	21	409,952
W6CN	14	73,872
WB7OCV	14	47,085
W6QU	7	12,420
W8QZA/6	3.7	2,112

MULTI-OPERATOR SINGLE TRANSMITTER

W6XR		**11,231,169**
WV2LI		9,314,195
AA5NT		8,165,840
N3OC		8,135,677
AA4NC		7,256,784
NM5O		7,112,322
KR5DX		6,912,928
AJ1I		6,869,394
KRØB		6,791,568
KD9ST		6,008,952

MULTI-OPERATOR MULTI-TRANSMITTER

KM3T		29,338,460
KT8X		26,642,082
NR6O		25,106,150
W4MYA		21,302,088
NQ4I		20,491,481
KI7Y		14,919,912
NK7U		11,610,216
K2BM		11,176,000
NE6N		9,818,802
KØAB		6,775,197

** Low power*

very active, including 9AY2K, 7S2000M, and AX2000. In addition, many of the EA stations got to use AM or AN, and the SM's were sporting new contest calls such as 8S2F, 7S5A, 7S2E, and others. Two of the newest DXCC entities were on also, with TXØDX and 4W6GH giving out a new country to many. Thanks to all who make the effort to get a special call, go on an expedition, or just get on and hand out points from some of the more exotic QTHs. Your efforts help to make the WPX an exciting contest each year.

The log-checking crew did a fantastic job again. Without the help of NA2X and N9AG it would not be possible to get these results out on time. Also my thanks to OH1EH, EA3DU, and F6JSZ for collecting and forwarding logs and providing other assistance and guidance. Also, thanks to K3EST, who puts together much of the WPX write-up that appears in *CQ Contest* magazine. Don't forget to check out the February issue of *CQ Contest* for more WPX results and articles.

The 2001 WPX contest dates are 24–25 March for SSB and 26–27 May for CW. Mark these dates on your contest calendars and give the WPX a try. 2001 could be a banner year for contesting. Paper logs sheets can be obtained from the *CQ* office for an SASE or can be downloaded from the WPX website (PDF format). E-mail logs should be sent to <N8BJQ@erinet.com> and should contain your call, category, and mode on the subject line. Paper logs should be mailed to CQ WPX Contest at 25 Newbridge Road, Hicksville, NY 11801 USA. Please mark WPX SSB or WPX CW on the outside of the envelope so they get sorted and sent to the correct place.

Thanks for taking part in the 2000 contest and give the WPX a shot in 2001.

73, Steve, N8BJQ

CQ website: <www.cq-amateur-radio.com>
CQ WPX Contest website: <http://ourworld.compuserve.com/homepages/n8bjq>

Random Comments

It was a new experience to work the contest barefoot! No problems of remembering band switching the power amplifier, no power with our neighbors, and no problems with high temperatures in the shack . . . **7S5S**. Despite snowstorm, rig and antenna performed perfect and excellent service from my housekeeper (hi) . . . **8S7A**. This was my last contest from this QTH and I enjoyed it very much. Where were all the JA's? Missed hundreds of them as it is very difficult from here to JA's short path because of the European wall. Almost no LP opening to that part of the world and I sooo expected and hoped for it . . . **9G5ZW**. Getting caught between LU and JA can be kinda fun! Great condx on 10 m . . . **AC5SU**. Great conditions. It's really fun to have runs at odd times, like 20 m at 0600 local time, when it seems the band is open to large parts of the world . . . **AE6Y**. First time SO2R—amazing to hear VP6BR in one ear and A61AJ in the other! . . . **AK6R**. Yes! My grandson birth on 26, so adios, goodbye contest. I give to my son a calendar with the contest dates. He is advised to bring us the new one out of the contest dates (hi) . . . **CT1AOZ**. My first WPX contest. UFB! Had a good time . . . **DA1LDN**. DN1MA is a trainee call. Markus is 6 years old . . . **DN1MA**. Reached 1 million points 24 minutes before the contest closed. As with last year, Europe never opens on Saturday . . . **DU7MHA**.

Thanks to power company to cut the power during 2 hours when my average was 110 Q/h also thanks to my neighbors to have TV and telephones prepared to listen and capture ham transmissions . . . **EA3QP**. Everybody was on 10/15 this year and the low frequency bands consequently were not as busy. 10 m really opened up for this one and on both evenings was open until late in the evening . . . **EI4DW**. 10 meters very opening a pleasure! . . . **F5AOV**. Some good DX on 10 m . . . **GØDEZ**. Had a good one. Got sponsored by workmates and raised about $500 for charity . . . **GØNWY**. Despite having checked out the whole station on Friday, the first attempt to use my beam showed a very high SWR which made it impossible to use, hence the vertical on 10, 15, and 20. I was still happy just to be able to take part as I had to attend a wedding on Saturday afternoon and evening. Anyway, the vertical performed very well! . . . **G3VAO**. I'm usually a CW-only man, but the disgusting antics of the TXØDX chasers drove me up to the SSB end in despair. Once there, I got hooked on the shouting mode and I more than doubled my SSB country total!! . . . **G3VQO**. Yes at last! A decent North America opening on 10 m during WPX, and look at what it did to my score: 58% higher than the Asian record I set last year! . . . **H22H**.

Super conditions to the U.S. and Europe. Low power couldn't break some of the piles on some good DX, but performed well. Thanks to Mr Mason of the Ministry of Communications for the use of the special J64 prefix, and to Kirk J68ID, Don J68DD, and Todd J68TD for sharing the work and the fun of J6 . . . **J64AS**. Enjoyed!! I came back to this big contest after long QRT (15 years); it was still great!! . . . **JA6BGA**.

Visit Our Web Site

CONTINENTAL LEADERS

AFRICA

1.8	No Entry	
3.5	No Entry	
7	No Entry	
14	*9E1C	1,785,525
21	5NØW	8,122,044
28	EA8AH	14,567,148
AB	3V8BB	15,266,880

ASIA

1.8	4X4NJ	157,014
3.5	*JE1SPY	1,975
7	UA9AM	384,930
14	5B4LP	5,263,200
21	RVØAR	4,484,480
28	H22H	9,092,146
AB	C4A	11,745,600

EUROPE

1.8	S57M	282,382
3.5	YTØA	1,527,608
7	OK1RI	4,079,256
14	DJ7AA	7,955,224
21	CQ1BOP	6,989,997
28	GM7V	8,305,756
AB	IR2W	9,162,675

NORTH AMERICA

1.8	AA4MM	56,448
3.5	VE1BY	2,226,300
7	KD4RH	71,043
14	KK9A	6,621,446
21	VE6JY	8,822,016
28	KP2A	11,385,710
AB	KQ2M	11,875,240

OCEANIA

1.8	AH7R	5,292
3.5	AH6OZ	392,175
7	No Entry	
14	No Entry	
21	AH7DX	7,645,990
28	TXØDX	12,049,422
AB	NH7A	10,602,210

SOUTH AMERICA

1.8	No Entry	
3.5	No Entry	
7	PY2NY	254,794
14	*ZZ7Z	47,725
21	L99D	5,892,976
28	L2F	8,861,904
AB	P4ØV	16,638,841

MULTI-OPERATOR SINGLE TRANSMITTER

AF	CQ9K	15,265,972
AS	UPØL	13,023,592
EU	TM1C	16,768,719
NA	VP5V	21,623,154
OC	7AØA	6,502,840
SA	PTØF	21,776,546

MULTI -OPERATOR MULTI -TRANSMITTER

AF	No Entry	
AS	P3A	53,554,592
EU	9AY2K	42,477,343
NA	WL7E	42,013,215
OC	DX1DBT	1,627,920
SA	ZX5J	46,550,452

It was quite exciting. There was very long opening in the 10 m. EU's and NA's were heard at the same time, and 15 m was not closed . . . **JA9SCB/1**. I am so excited to establish the new JA record . . . **JH4UYB**. Thanks to great condx, enjoyed good rates for hours! Please NO LAST TWO LETTERS nor partial callsigns. Those are merely wastes of our precious time . . . **JH7PKU**. I am age 8. My first DX contest . . . **JQ6QKM**. Some very strange condx . . . **KØCOP/4**. Static on 160 meters was only 40 dB over 9 this time! . . . **KØCS**. What a blast! Great conditions, especially on 10 . . . **K2FR**. Missed first 16 hours. Other than that it was fabulous! . . . **K2XR**.

Had fun, relaxed, took my time, all S&P with a very few CQ's. Think I had problems with voice keyer that killed the CQ's. Worked several new countries . . . **K4OOO**. 10 was so long I missed too many US prefixes. The long-path opening to Asia and Europe was frustrating; only three stations could hear me . . . **K5RX**. Fun working all the 2000 calls. Worked 9AY2K on 6 bands! . . . **K5ZD**. This contest is quite a challenge. I am disabled with Chronic Obstructive Pulmonary Disease and am on oxygen 24 hours a day . . .**K6CSL**. Nothing like a short power outage to get the juices flowing! . . . **K7ZZ**. Have not participated in all band for several years. I had a terrific time. Great idea adding points for own country . . . **K9OP**. Lots of DX! . . . **KB5EKX**. I tried working 9N7RB the week before the contest and couldn't break the pileup. I was flabbergasted when I heard 9N7RB call me during the contest. Both Laos and Nepal were new countries for me! . . . **KC3TL**. My first contest. I got my wife and 2- year-old son a hotel room with a pool for the weekend so I could have the house to myself. Can't wait till next year . . . **KC8MNO**. Congratulations to everyone who worked 9M6AAC; excellent signal here both days. Did not get through the *huge* pileup! . . . **KD4RH**. What an *outstanding contest!* I thought that I did a good job last year! Band conditions were absolutely outstanding! My best effort ever . . . **KE9NA**. The best JA opening that I have ever seen. It was great breaking KC1XX's 1995 20M record! . . . **KK9A**.

WOW! Great cndx and stinko cndx 15 minutes apart all weekend made taking off times and figuring strategy a real challenge. Activity down from ARRL Phone but wild 10 meter LP & SP opening Sunday AM to SE Asia made up for it. Sacrificed score to break 4000 QSOs (vanity) as those EU 6 pointers on 40 and 80 are worth more than stateside on 10. Lots of fun! Congrats to all the guys with big scores . . . **KQ2M**. The XYL, Margaret, thinks contesting is a bit looney, but she graciously took on our three two-year-old sons (yes, triplets) for the weekend, which allowed me to operate almost 30 hours. I had a wonderful time . . . **KR4QI**. First contact — Marshall Is . . . **KS4JB**. Hooray for sunspots; 10 m is the place to have a ball from this neck of the woods . . . **KS7T**. S&P all weekend with low power gve me a lot of exercise for my knob turning fingers . . . **KW4T**. First try at contesting . . . **KX9DX**. Mni tnx to WO1N for braille to CT transcription! . . . **KY1B**. Fabulous conditions. Plenty of activity. All adds up to great fun . . . **KZ5D**. Was interesting to use LU6ETB's station; meanwhile he was in ZX5J, because we can do some comparison on our score during the contest. The propagation was very strange, because in first 8 hours I made 900 QSOs, but in the next 12 hours I only did 200. Murphy is very

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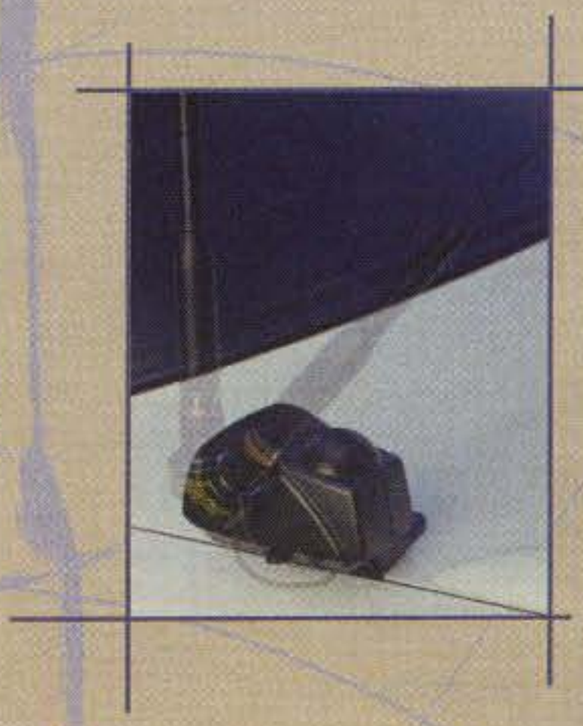
From Professional Engineers



MK-30H Motorized Mount

The ultimate in convenience.

12VDC Heavy Duty Motor with Remote Switch
Attaches easily to trunk lids or the rear door of Vans/SUVs. 360° adjustable. Slip-clutch protects the motor gears from stripping. Max Antenna Height: 62 inches. Max Antenna Weight: 16oz. Accepts standard SO-239 cable assembly (FVS-50) for mounting PL-

PRM-T Heavy Duty Lip Mount

Attaches to a trunk or rear door of Vans/SUVs. Holds antennas up to 85 inches securely. Completely adjustable, rubber gasket protects vehicle paint.

FVS-50 Deluxe Coax Cable Assembly

Attach the FVS-50 to the PRM-T heavy duty adjustable mobile mount. 16 feet 9 inches total length with 18 inches of RG-188 type coax for easy entry into the vehicle without causing wind noise, water leaks or coax damage. PL-259 barrel is detachable for easy installation, weather cap included.

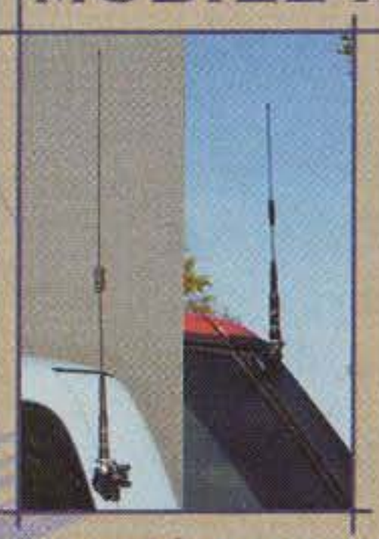
HT ANTENNAS

"Cat Whisker" whip is lightweight and very durable. Made from the same material as unbreakable eyeglass frames.

AS-30
2M/70cm HT "GAIN" Antenna
Gain: 0/2.15 Length: 15 inches
Conn: SMA

AS-20
2M/70cm HT Antenna
Length: 8.5 inches
Conn: SMA

MOBILE ANTENNAS



EX-104B/EX-104BNMO
2M/70cm Dualband Antenna
Gain: 0/2.15dBi Length: 15 inches
Max Power: 50W Conn: PL-259 or NMO

EX-107RB/EX-107RBNMO
2M/70cm Dualband Antenna
Gain: 2.6/4.9dBi Length: 29 inches
Max Power: 80W Conn: PL-259 or NMO
Ground Independent

SHG-140B/SHG-140BNMO
2M Mobile Antenna
Gain: 4.1dBi Center Loaded 5/8 wave
Length: 56 inches Max Power: 200W
Conn: PL-259 or NMO
Ground Independent

SHG-1500B/SHG-1500BNMO
2M/70cm Mobile Antenna
Gain: 4.5/7.5dBi Length: 59 inches
Max Power: 200W Conn: PL-259 or NMO
Ground Independent

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VX-150
Compact yet incredibly rugged 2-meter handheld is designed to perform under the most difficult operating conditions. And it's packed with the leading-edge features you've come to expect from a Yaesu product. Five Watt power-output, 209 memories, DCS/CTCSS, 7 digit alphanumeric display, automatic repeater shift and much more.

FT-50RD
This durable, multi-featured
5 Watt Dual Bander is manufactured to rigid MIL-810 standards. Featuring wideband frequency coverage,* CTCSS/DCS operation, Dual Watch, 112 memory channels, and Digital Voice Storage.

FT23RMKII/FT33R
These ultra-compact, 5 Watt VHF FM Handhelds feature rugged die-cast aluminum cases, 10 memory channels, optional CTCSS, and multiple scan modes. The FT23RMKII (2M) and the FT-33R (222 MHz) are easy to operate, and give outstanding performance.

VX-1R
The pocket-sized VX-1R is small in size only. Featuring Smart Search,™ DCS/CTCSS, Dual Watch, ARTS,™ wide-band coverage (76–999* MHz plus AM BC). The VX-1R provides 291 memory channels, and puts out ½ Watt (1 Watt w/optional E-DC-15 DC Adapter).

* Cellular Blocked

VX-110
This incredibly rugged 5 Watt VHF handheld features 209 memories, Smart Search,™ DCS/CTCSS, simple 8 key operation and Omni Glow™ display illumination for night time operation.

VR-500
This miniature Handheld Receiver provides FM, AM, SSB and CW reception on 100 kHz–1300 MHz, with 1091 memory channels, Smart Search,™ versatile Dot Matrix display, Band Scope, and Dual Watch.

FT411MKII
The affordable FT411MKII is compact and durable. This 5 Watt VHF FM Handheld features a die-cast case, 40 memory channels, 10 DTMF memories, built-in VOX, and multiple scan modes.

VX-5R
Although Yaesu's newest Tri-Band Handheld Transceiver is the world's smallest, it offers the performance of a full-size unit. The VX-5R operates on the 50 MHz, 144 MHz and 430 MHz bands with 5 Watts of power output, along with ultra-wide receive coverage of the VHF and UHF spectrum, plus AM medium- and short-wave broadcast reception. The VX-5R is military rated, so its durable, lightweight design allows you to take it anywhere. It is equally suited to walking through the concrete jungle as it is to forging the raging rivers of a real one. Along with a temperature display, the optional barometer pressure sensor unit gives a read-out of barometric pressure and altitude.

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When you're small, you get picked on. Isn't that how it goes? Well not in Yaesu territory, because not only do we design compact handhelds for efficiency, but we give these clever little guys plenty of muscle. Yaesu handheld transceivers have earned the bragging rights for being the smallest handhelds with the most durable water resistant casings ever created. And packed inside the brawn are engineering accomplishments in performance that are unmatched in the industry. Our high-tech handheld transceivers provide clean power output on the VHF and UHF bands and offer revolutionary features that allows these tough guys to continually outperform the competition. Learn more about Yaesu products on the web at www.yaesu.com

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THE PROFESSIONAL STANDARD

The compact desk-top VR-5000 is Yaesu's most versatile Communications Receiver ever! With ultra-wide frequency coverage and a host of operating features, you'll be on top of the monitoring action with the VR-5000!

● CONTINUOUS FREQUENCY COVERAGE: 100 kHz ~ 2.6 GHz!

The VR-5000 provides continuous coverage from 100 kHz to 2599.99998 MHz (cellular frequencies are blocked) on all popular operating modes: LSB, USB, CW, AM-Narrow, AM, Wide AM, FM-Narrow, and Wide FM. The "Auto Mode" feature automatically presets the operating mode and frequency steps for the frequency range you have chosen!

● 2000 MEMORY CHANNELS!

The extensive memory capability of the VR-5000 includes 100 Memory Groups, allowing you to partition the Memories for easy recall. And you can add an Alpha-Numeric label to both Memories and Memory Groups, to make channel identification easy and quick!

● DUAL RECEIVE!

When monitoring on the "Main" displayed frequency, you can simultaneously listen to a second station (on the AM and FM modes) operating within 20 MHz of the Main frequency. This can be especially helpful while monitoring public safety communications.

● DIGITAL SIGNAL PROCESSING (OPTION)!

The optional DSP-1 Digital Signal Processing Unit provides leading-edge selectivity, and it includes (1) a Bandpass Filter for razor sharp selectivity on SSB/AM/FM, (2) a Noise Reduction Filter, (3) a seeking Automatic Notch Filter to eliminate heterodynes, and (4) a narrow CW Peaking Filter, for weak signal reception of Morse Code signals.

● REAL-TIME SPECTRUM SCOPE!

To aid in finding band activity, the VR-5000's Real-Time Spectrum Scope will sweep the band in user-defined steps, displaying the received signals graphically according to frequency and signal strength.

● WORLD CLOCK WITH UTC/LOCAL SETTINGS!

The World Clock feature of the VR-5000 includes an atlas with 66 geographical references, and it also provides a Program Timer (with automatic switching to a designated frequency), an Alarm Timer (wake up to a Shortwave Broadcast), and a Sleep Timer (drift off listening to your favorite FM station).

● PRESET SHORTWAVE BROADCAST STATION MEMORY BANK!

Featuring a handy world map showing station locations, the special Shortwave Broadcast Station Memory Bank includes several different operating frequencies for a number of popular shortwave stations, including Voice of America, the BBC, Radio Japan, and the Voice of Russia. The operating frequencies may be changed by the owner, to keep up with changing station schedules!

● EXTENSIVE SCANNING CAPABILITY!

Scan the band, the memories, or a band segment with the VR-5000's versatile scanning system. And Yaesu's exclusive Smart Search™ system will scan the band, looking for activity, and will automatically load active channels into a special Smart Search™ memory bank!

AND MUCH, MUCH MORE. . .

● "RF Tune" Front-end Preselector (1.89-1000 MHz). ● 20 dB Attenuator for strong signal environments. ● IF Noise Blanker. ● DVS-4 Digital Voice Recorder (option) with two memories of up to 8 seconds each. ● FVS-1A Voice Synthesizer (option) for audible announcement of the operating frequency. ● 10.7 MHz IF Output Jack. ● Field Strength Meter. ● Audio Tone Control. ● All-Mode Squelch Control for silent monitoring. ● Password-protected Panel and Dial "Lock" feature. ● Display Dimmer/Contrast Control. ● Clone Capability for copying memory information from one VR-5000 to another.● Personal Computer Interface Port (4800/9600/57600 bps). ● Two Antenna Ports. ● Audio Wave Meter provides display of incoming signal's wave characteristics.

COMMUNICATIONS RECEIVER
VR-5000

0.1~2599.99998MHz*
LSB/USB/CW/AM-N/AM/
WAM/FM-N/WFM
*Cellular blocked

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smart. He visit edme and stroke in the only two things where I haven't spare parts. The cable between the power supply and the rig was burned, and the microphone element broken. He's smartest every year. Also something happen than I feel like in my home. I have the same TVI problem than in my QTH. See you in WRTC 2000!! . . . **L99D**.

I was prepared to operate in serious manner this year, but after 10 hours my PA blew out so I decided to switch to gardening instead . . . .**LY2OX**. First attempt at large HF contest. Enjoyed very much, but proved hard work with attack of gall stones at same time!! Really pleased to work some exotic DX. Will certainly be back next time with hopefully improved station . . . **MØAFC**. First attempt at a worldwide contest . . . **MØBEX**. Very enjoyable contest . . . **MØBRK**. I had a sore throat after the contest. I think it is time I invested in a CQ caller for the rig. I was very impressed with my new vertical antenna. This is one of my best contests. I am looking forward to the CW leg now . . . **M4T**. Great contest. Can't believe the score. Next time new equipment, new QTH, and no stray RF finding its way into my radio . . . **N1WK**. Another learning experience. Replaced the 20 m trap so 20 and 40 m were usable. Had my first Q ever on 40 from this QTH. I called several others but during the contest no one else heard me . . . **N3HXQ**. First real contest. A little nerve wracking but fun . . . **N3ZEL**. Part time effort, guests from Austria . . . **N4BP**. Had S-9 line noise all weekend. Sure makes it hard to work the weak ones . . . **N4IG**. Great activity and lots of new prefixes. The one point for working own country is good . . . **N4UH**.

Outstanding conditions. Wish I could have operated more. Got the Alpha 99 the day before the contest. What a great piece of equipment! . . . **N5RZ**. Had a blast! Didn't get on the low bands much; 10, 15, 20 were just too hot! . . . **N7LOX**. I had a ball!! 10 meters was awesome from my QTH! . . . **N8CN**. Very tough on 40 m working split barefoot (95 watts). Worked a new one (P29NB) first call! . . . **N8LIQ**. Great contest again. Doubled my score . . . **N9GUN**. This contest was great! . . . **N9HCA**. Worked more Europeans than U.S. on 15! . . . **NH7A**. I only worked the last hour of the contest, but I made some people very happy with the last-minute multiplier . . . **NI2P**. Saturday condx only fair, Sunday fabulous . . . **NN6NN**. Thanks to my host, OH1VR, for the station. This station was built by OH8QD in 1974 and ham shack is located in the old empty farmhouse some miles from the QTH of OF3F . . . **OH3MMM**. Best condx for 10 years . . . **OH5BM**. This time the conditions on 15 m were marginal to work any DX pileups . . . **OH6NIO**. Got to quit smoking if I want to win OH1F next year . . . **OH9MM**. Horrible jam on narrow 40 m band. New event—some digital mode coming out of UR, UA? 10–20 kHz wide (center around 7055 kHz) being on the air about 50% of the time wiping out everything! More tiring to make 1600 QSOs on 40 m than 3000 on all bands . . . **OK1RI**. I am very pleased contact with my son YI9OM . . . **OM6TX**. Amazing 10 m on Sunday evening, yielding exotic multipliers such as AH8, TXØ, and KH6's. Great contest again. Best personal score ever . . . **ON4APU**.

First time I ever reach the 1,000,000 mark since I got my license back in '95. Anyone complaining about cycle 23 should have monitored 10 m during the contest. Worked a bunch of new prefixes. Just hope these guys will now QSL . . . **ON4CAS**. I am not an SSB man, but found I had enough QSOs to send in a log . . . **ON7SS**. Condx on the good old 10 meters excellent!! . . . **PAØKDM**. At first day beside us on the Sakhalin island was a storm, with the snow and strong winds. Turn an antenna as not possible, happen to work how will come. In the end total was completely remove from building my 2-element 40 m antenna, but fortunately come in well condx on 10/15 m. One more such contest with such storm and I will stay without antennas, hi, hi . . . **RAØFF**. I don't like phone contests, but I like WPX contests . . . **RA3XO**. Ten was great open for NA. Was not working many Japanese (as 1999 WPX). Enjoyed the contest . . . **RW4AA**. The WPX contests are always really worth working! . . . **SM6FUD**. Thanks for another nice WPX contest . . . **SW2A**. I've been using UA3AB's country shack and enjoyed much the condx and fresh air . . . **UA3DPX**. Good condition during the contest . . . **UU2JZ**. Superb conditions, especially on 28 MHz . . . **VA3DX**. Planned to do more but the flu got in my way! . . . **VA6SV**. What can I say! Absolutely fantastic conditions. The band was open all weekend, the best I have heard in 25 years or more, plus operating with special call VC3M for the first time really helped me break the 5 Meg score low power . . . **VC3M**.

Personal best score in this contest, although conditions didn't seem quite as sharp as in the ARRL DX last month. But who's to complain? I had a great time . . . **VE3BUC**. Ya gotta love 10 m! So much room to stretch out and actually run a few people with the 100 w pea-shooter! Even at 28.850+ you could develop some decent results. If only 40 m had that kind of space in the darkness . . . **VE3STT**. Superb contest under superb conditions . . . **VE3ZZ**. Biggest kick: working 9E1C for #292 with one call! . . . **VE6ZT**. The conditions were fantastic and at times downright amazing . . . **VK4UC**. Very interesting long path openings from here to Europe. On 15 they provided many contacts and much of the mults. The path was good enough that I had the luxury, for a change, of being loud enough to control the frequency! Even more fascinating was a long path opening to PA and G on 10 around 2200Z—very odd! . . . **VK5GN**. Disrupted by a kangaroo getting into the shack and pulling out the power cables . . . **VK8HZ**. Had a great time doing the contest. Looking forward to the next one . . . **W2MF**. Had a lot of fun. Operating time limited Saturday due to trip to Memphis to see Tennessee Lady Vols beat UVA in NCAA Regional basketball. Go Vols! . . . **W4TDB**. Great to have 9N and A4 call while running EU on 10 m early Sunday morning. Fun to hear signals from all directions at same time on 10 meters; better enjoy while we can! Sorry I couldn't put in more time, but best overall total Q's/minutes effort to date. Thanks to all the JA gang; sure helps us left coasters . . . **W6TK**.

Another weekend of great conditions. Operated far more than had planned. Thanks to the 13 European stations that were able to pull my 100 watts through on 40 meters, all the second night . . . **W7YAQ**. A 9G5, two JA's, and 99 contacts while running 25 watts mobile on 10 m made the contest very enjoyable . . . **W9CNF/M4**. Much enthusiasm by the ops. I didn't have much time to give to this test . . . **W9YS**. Worked nine new countries! . . . **WA4MA**. My last contest as a Tech Plus . . . **WA5VKS/T**. Sure enjoyed all the action on 10 m . . . **WB8TLI**. I'm a low-key S&P-only contester. Last year got 400 QSOs for first time ever. This year 500. Wow! . . . **WK5K**. A single band effort is much easier on the body than an all band effort! . . . **WY6K**. Nice contest for low power . . . **YL2GN**. A mobile operation with an antenna tuner which was *not* built for the rig and a whip antenna which was also *not* buildt for ham use, but for military use, is already not an easy task. But with a car battery which had to be recharged in regular intervals by stopping the contest operation and driving the car around makes a contest to a real challenge . . . **ZS6IR/ZL/M**. Had fun! . . . **AF9J**. I had a ball. I was so wrapped up in my contest I lost track of time . . . **JA5GPJ**.

New cycle propagation gave the big power to my 5 watt rig. Three years ago only 115 stations with 1KW out. Hi . . . **JH6SQI**. Strangest conditions I've ever seen . . . .NA4CW. Nice contest . . . **OK1GW**. Not much time available for the contest, but even so it is fun to make a few QRP contacts. I feel like David among all those Goliaths . . . **W3MGL**. This contest to me *is* the big dance!! A61 and SU9 just topped it off! . . . **WB7OCV**. Next year I hope will work with my homemade power amplifier in this contest . . . **YO6PED**. Conditions seemed good, but it was really tough to compete with modest power (less than UK legal limit) and modest antennas (tribander and dipoles at 30 ft.) . . . **GB3RS**. 100% YL operation . . . **JN1YUU**. A team of rookie ops; we had a ball . . . **KØGQ**. This contest, as all others, would not have been possible without the support and help of my wife Tam . . . **KD9ST**. With other obligations, no full time effort possible, had to sleep sometime (hi). Not too bad for a two op multi-single. Had a great time with the contest. Being semi-rare KU4 made it really fun . . . **KU4RG**. This was our first contest from LA7G contest team. We had a great time and we hope to see all of you in further contests . . . **LA7G**. LS7N is special call of LU1NF. QSL via LU1NF . . . **LS7N**.

This entry was generated just for fun within a few hours before and after our WRTC training session as OE2S . . . **OE/DL6FBL**. No comments other than great condx, crappy antennas, lots of beer, and here are the results just to help CCF to beat NCCC . . . **OH6K**. SPØZCC is a special event call used celebrating 20 years of the Scouts Radio Club SP5ZCC. We had great fun operating in this year WPX . . . **SPØZCC**. Glad to know many young hams are interested in this club station activity. Moreover, many DX stations received mults from us! . . . **YBØZDC**. This was a training session for the WRTC 2000 in Slovenia, so we tried to simulate WRTC conditions. We operated on 20 hours out of 24, had one TX rig running barefoot, and limited antennas . . . **DLØMA**. Working no one Saturday until Shana delivered her special All-Band-Opening-Aurora-Destroyer pizza . . . **KL7RA**. Next year we'll launch a full effort; we spent too much time sleeping this year . . . **KM3T**. Fabulous conditions on the high bands, but it hurt activity on the low bands. Great fun to compete against the other multi-multi entries. Congrats to all on great scores . . . **KT8X**. We used this contest to emulate WRTC conditions (Sat. 1200Z – Sun 1200Z with breaks, 100 watts, and small antennas) . . . **OE2S**. This turned out to be the one we had been working and waiting for the last several years. Enough good ops so no one had to work too hard. Lots of good fellowship. It doesn't get any better . . . **VE5RI**. Before the contest we had to sweep up the blown diodes. During the contest half of the equipment dropped off because of a blown breaker that could not be reset. Conditions were real good . . . **VE6FI**.

Station Operators Multi-Op Single Transmitter

4N7N: YU7QL, YU7WW, YU7HI, YZ7MFK, YU7AEC. **7AØA**: YBØAZ, YBFØDX, YBØAVK, YBØCBI, YBØECT, YCØLBK, YCØGOF, YCØHXH. **9A1V**: 9A4VV, 9A4DU, 9A6DX, 9A4RV, 9A4MD. **9A7A**: 9A8A, 9A3OS, 9A4PA, 9A4RX, 9A6DM. **9A8M:** Club group. **AA4NC:** AA4NC, KI7WX, KS4XG. **AA5NT:** AA5NT, WD5FLK, W5WW, N5EE, WJ1U, KC5LBE, N5TVL, KC5WBU, N5NJ. **AB2DE:** N2KPB & KC2AVE. **AC4XO:** AC4XO, N4GU, N4EL, KF4YLM, KU4YL. **AJ1I:** KB1H, N1XS, KB1DFB, NB1U, KE1LI. **AM1RCT:** EA1APM, EA1AUN, EA1DLD. **AM3RKG:** EA3BOW, EA3BOX, EA3DGQ, EA3EIO. **AM4ST:** EA4ATI & EA4ST. **AM4URA:** EA4AAH, EA4BHO, EA4EOW, EA4AHE, EA4AHU. **AN1AAW:** EA1AAW, EA1EB, EA1BAW. **AN1COZ:** EA1COZ, EA1EAG, EA1AS. **AN1URG:** Club group. **AN5BX:** EA5BX, EA5ZI, EA5FFC, EA5AFH, EA5GMO. **AN8URL:** EA8AAG, EA8AJW, EA8AKN, EA8AQE, EA8BIK, EA8BVX, EA8CAJ, EA8DP, EA8EE, EA8FO, EA8NL, EC8ABT, EC8APU. **AX2ØØØ:** VK2BYN, VK2ETJ, VK2FLB, VK2IA, VK2JN, VK2SKY, VP8CWI. **B4R:** BA4RD, BA4RF, BG4RUC, BD5RV. **BY2JCY:** 1Ø members ARC of Changchun Institue of Post and Telecommunications & DL2HBX. **BY4AOH:** VR2SS, 7K1OUO, BA4DW. **BY4BZB:** Sun, BD4ED, KC6WYX, numerous student operators. **CQ9K:** CT3BD, CT3BM, CT3DL, CT3HK, CT3KU, CT3IA. **CS6RPA:** CT1GVN & CT2GQN. **D73A:** HL1XP, HL1KFW, DS1BHE. **DHØHTE:** DF7ATW, DH1TW, DL1SFK, DL3SBI. **DK9TN:** DK1NO, DK9TN, DL2SFI. **DLØGH:** DJ2MX, DL1ZU, DF4FAY. **DL1YFF:** DK1QH & DF6V. **DL2ARD:** DL2ARD, DL1WA, DL2AMC, DH1NAX. **DL3KZA:** DL1KZA & DL3KZA. **DX1CW:** 4F1FZ, DU1WHO, 4F1EAA, 4F1CJC, 4F3XX, 4F1BYN, 4D1PMD, 4F4AKH, DY1PDO, Raymond. **DX1DX:** DU1MS, DU1SAN, DU1MII, DU1QNT, DU3SV, DU1WP, DU1MHX, DU1UVP, Elma, Gilbert. **DX1RN:** DU1LER, DU1TLD, DY1NRA, DY1PUI, 4F1PBM, DU1RXE, DU1UUX, DY1PMK, DY1MDU, DY1UKC, DY1MKT, Bong, Roy, Marvin, Allan, Arnie, Hernan, Anthony.

EA1EEY: EA1EEY, EA1CS, EA1DZW, EA1CUB, EA1BVP, EA1BXW. **EA4RKU:** Club Group. **ED5AQP:** EA5AQP, EA5FGE, EC5AAX, EC5AMB. **EN7Z:** UR7ZZ, UTØZZ, UT4ZO, UY3IM. **ES1XQ:** Toenu, ES1THQ, ES2THY, ES3THP, Andre. **ES2X:** ES2RJ, ES2QH, ES1LAA, ES2NA. **EU5F:** EU6DX, EW6AF, EW6TU, EU6CQ, EW6MM, EW6OO. **F5AMH:** Club Group. **F5EMP:** F5EMP & F5BGR. **F5KQN:** F5PFT, F5SNY, F5TGC, F6FET, F8BAE, F5PGO, F8BOD, F1PUJ, F4BWC. **F6KZC:** F5IRY, F5BVQ, F11NZB. **F8CGL:** F8CGL & F6KFI. **F9FE:** F8BPN, F5NBX, F6CQU, F6BHI, F9FE, F6HKA. **FM5BH:** FM5FJ, FM5GU, FM5BH, FM5DS, FM5GU. **G6A:** GØKXL, GØIEQ, G4WSE, G4NXG, G3RTU, MØCOC. **GB3RS:** G4JVG, GØWAT, 2EØAPH, 5B4WN, GØHSD, G3ZVW. **GX3FEC:** G3YBY, G3RZP, MØACM, GØBCT, G4DIE, M1CBM, M1CWN, G7CNP. **GX6YB:** GØWKW, G3TKF, G3XSV, G4KDS, MØAXF, G7ORR, 2EØAUL. **HLØO:** Club Group. **HSØAC:** HS1CKC, HSØGBI, E21EIC, HSØ/G3NOM, HS6NDK, E2ØREX, E2ØGMY. **I4GAS:** I4GAS, I4AUM, I4GAD. **IK1SLE:** IK1SLE, IZ1BPR, IK1NLZ, IK1RLI. **IQ9K:** Club Group. **IY4W:** I4UFH, I4JMY, I4YSS, I4LEC, IK4MHB, IK4UPB, I4JED. **JA5YGJ:** JA5MVU, JI1T5HN, JF4UNO, N. Yoshida, H. Yasuoka. **JE4VVM:** JE4VVM, JG4CLV, JH4UHW, JN4FEU. **JH2YSS:** JN2FMH & JK2CVU. **JI2ZEY:** JA2BY, JA2BIV, JA2BIL, JM2CCL, JQ2BBC. **JI2ZJS:** JA2AXB, JA2JSF, JG2TSL, JH2UVL, JM2RUV, JH1BXH. **JJ3YBB:** JA3PJL, JA3OOK, JF3MOK, JF3RLG, JF3EBO, JE6EKC, JS3VEX. **JN1YUU:** 7M4NBR, 7M4JVV, 7M4WVB, 7M4UVV, 7M4WIK, 7M4WMM, 7N4HIL, 7M4WDM, 7M4WIL, H. Tabuse, Y. Inokur, A. Yaamoto. **JW8G:** Club Group.

KØDE: KØDE, KCØEXR, N2IC. **KØGQ:** KØOU, KBØRTH, KCØEMA, NØEVH. **KA1VMG:** KA1VMG & N1ZRD. **KD8SQ:** KD8SQ, KA8YNW, KC8MRP, K8FXE. **KD9ST:** KD9ST, KA9SQR, KA9SQS, KB9EXE. **KO7X:** W7CT, NG7M, KO7X. **KRØB:** KRØB, NØBKL, KSØT, KJØB, NØRA, KBØKQA. **KR5DX:** W5SB, K1OJ, W5BAK, W5IDX, KF5SB, K5ZTY, KK5LD, WA5SAJ, KØCO, W5MN, K5NZ. **KU4RG:** KU4RG & KF4OKG. **LA7G:** LA3TR, LA4MJA, LA5QFA, LA6EIA, LA7WCA, LA7IJA. **LS7N:**

LU4NA, LU1NDC, LU8NA, LU1NAF, Otto, Tom. **LT5Y:** LU1YU, LU2YX, LU3YBI. LU1FC: LU6FF & LU1FNH. LU4DRC: LU3EUO & LW1DTZ. **LX9SW:** LX1RQ & LX1AQ. **M2H:** GØREP & G3MXH. **N1XL:** N1XL & K2GH. **N3OC:** N3OC & WR3Z. **N9LCR:** K9NR, KF9IF, AA9GG, N9REG, N9LCR. **NM5O:** N5YA, K5WO, N5KB, N5KR, KK7JS, WB2LMA, KB5SSV, N3BUO. **NT4TT:** NT4TT, N4ZIQ, NR7Z, KC4SSN, N1FFN, Leo Reilly. **NY4I:** NY4I & K7MZ. **NY4T:** NY4T, N4JN, KE4KMG, KD4BAM, KR4FO, KF4AIG, N4SSD, KF4GNV. **OE/DL6FBL:** DL6FBL & OE2VEL. **OF3F:** OH1VR, OH1MM, OH6LI. **OHØZ:** OH1EH & OH1JT. **OH2U:** OH2HE, OH2IW, OH2XX. **OH2YLS:** OH2IO & OH1LDV. **OH4AB:** OH4KBC, OH4JFN, OH4KEC. **OH6K:** OH6XX & ex OH6NU. **OH7M:** OH4XX, OH6LNI, OH7KD, ON7MHL, OH7MS. **OK1KCI:** OK1CPU, OK1DUO, OK1CDJ, OK1DOZ. **OK1KHL:** OK1TC & OK1PAT. **OK2KDS:** OK2VWB, OK2HIJ, OK2-22266. **OK2KOD:** OK2BHM, OK2WAZ, OK2BNX, OK2BJ. **OK2KRT:** OK2XA, OK2BUZ, OK2VMC. **OL1C:** OK1AN, OK1IPS, OK1IEC, OK1TIC, OK1FPQ, OK8AAM, OK1UZW. **OL5Q:** OK1HRA, OK1FFU, OK1VSL, OK1INC, OK1AYE. **OM3A:** OM3DX, OM3CGN, OM8AM, OM8AU, OM8AW, OM8DM, OMØWR. **OM3KWZ:** OM7RC, OM7AA, OM7AB, OM7AC, OM7ALH. **OM3KZA:** OM3CUG, OM3YDX, OM3TYC, OM3CHY. **OM5M:** OM3BH & OM2RA. **OM7M:** OM3PA, OM5RM, OM5RW, OM5ZW. **OTØC:** ON4ACA, ON4ALT, ON4AMI, ON4AJZ, ON4CEQ, ON6MR, ON7UN, ONLDIRK, ONLEDDY. **OTØP:** ON4LAM, ON5OO, ON6AH, ON6QR, ON6VL, ON7PC, ON7LX, ON4GO, ON5PV, ON4LEH. **OZ1JTE:** OZ1JSH, OZ1JTE, OZ1IEP. **OZ2AR:** OZ2Q, OZ1PIF, OZ3SW, OZ1FIT. **OZ7HVI:** OZ1AA, OZ1CJX, OZ1TV.

P39P: Demetris, Vassilis, George, Christakis, Antonis, Nicholas, Fernando, Michael. **PQ1S:** PY1KS & PY1NX. **PTØF:** PY5CC, N5FA, PYØFF. PY2ECP: PY2ECP & PU2NYV. **PY2GEC:** PY2ESZ & PR8RZJ. **RD3Q:** RN3QO, RW3QC, UA3QDX, RX3DCX, RN3QY, RW3QNZ. **RI3A:** UA3ASZ, RK3FM, RU3DGD, RA3DKE, RK3FA, RK3FT, RV3BA. **RK3VWA:** Nina, Andrey, Alexander, Dmitry. **RK4FWX:** RK4FD, RW4FZ, UA4FAR, UA4FCV, UA4FMV. **RK4WWA:** UA4WA, UA4WAN, RW4WA, RU4WW. **RK9CWW:** RZ9CO, UA9CIR, RX9CAZ, RA9CKQ, RA9CMO. **RK9SWT:** RA9ST & RZ9SR. **RZ1AWJ:** Club Group. **RZ3DZF:** Club Group. **RZ9WXK:** Vlad, Rustem, Vadim, Sasha. **S5ØS:** S5ØS, S59A, S58A. **S51MA:** S51MA, S52SK, S52OP, S57XZ. **SKØHB:** Club Group. **SK7A:** SM7BHM, SM7BQX, SM7CWI, SM7FTG, SM7GXR, SM7TIX, SM7WSP, SM7WZA. **SN6U:** SP6NVK & SP6OPE. **SN8V:** SP8GQU, SP8ARY, SP8LBK, SQ8BGJ. **SPØZCC:** SP5UAF, SP5TAT, SQ5BPM, SQ5EBJ, SQ5GVX, SQ5BPT, SQ5EBL, SQ5VJB, 3Z5AAN, SQ5HAB, SQ5SJR. **SP3KFH:** Club Group. SP5ZDH: SQ5HAR, SQ5JBC, Maciej, Lukasz. **SP9KDA:** SP9LJE, SP-8522, SP6GCU, SQ9CYW, SP6MQO. **SP9KDU:** SP9AVZ & SQ9FMU. **SP9KRT:** SP9ADU, SP9ZW, SP9EMI, SQ9FVR. **SP9LJD:** SP9ERV, SP9UON, SP9LJD. **TF3IRA:** TF3AO, TF3HP, TF3GB, TF3RJT, TF3VGT, TF3TNT. **TIØR:** TI2CDA, TI2DLL, TI2KI. **TM1C:** F6CTT, F5SNJ, F5PSG, F8AKS. **UN4L:** RN9AO & UA9BA. **UPØL:** UN9LW, UN7LAN, UN9LO. **UR3IWA:** US2IES, UR3IBM, UR3IFD, UR5IFB, UTØIO, UX7IM. **US8U:** UT5UUF, UT5UDG, UT5UPN, UT7UW. **UT4UWL:** Andres, Leonid, Dmitriy, Ivan, Alex. **UX8IXX:** UX8IX, US8IBS, US8ICA, US8IDV. **UZ4E:** US-E-655 & US-E-688. **V25WX:** W4WX & W1LR. **VA3MG:** VA3MG, VE3XL, VA3KA. **VA3SK:** VA3SK, VE3RZ, VA3MW, VA3PC. **VE1FQ:** Tim, Dave, Jim, Doug. **VE2CMH:** VA2MP, VE2HTW, VE2LOA, VE2HJG, VE2FAL, VA2TO, VE2YRT, VE2TPE, VA2CCT. **VE3RM:** VE3WIB, VE3RM, VA2SMF. **VE6SV:** VE6AQE, VE6BAB, VE6MRT, VE6NAP, VO1CV, VE5FX, VE6SV. **VK4WIL:** VK4CEJ, VK4DZ, VK4FJ, VK4SN, VK4NM. **VP5V:** W5AO & K5TT. **WØMA:** WØTT, KØMS, KEØLY, WØGOM, KØBX. **W2TOI:** KC2CPF, W2IK, W2FX, K2AP, N2UIC. **W3LJ:** W3LJ, K3NCO, W3IDT. **W6XR:** N2AU & W6XR. **W6YX:** W6KNS & N7MH. **W7IG:** KA7AGH, W7BJB, N7HA, W7IG, KC7Q, W7SIR, N7TL. **WB1GEX:** WB1GEX & KB1DFG. **WP2Z:** W6XK, N6DE, W7MH. **WV2LI:** N2GA & K2DO. **WX6M:** WX6M & W6DI. **YBØZDC:** YCØEHN, YDØIR, YDØDIO, YCØIFJ, YCØLOW, YDØKJI, YDØKJO. **YL4U:** YL2KL, YL2KA, YL3CW, RA3CW, RZ3BW, RZ4HF, RA4HTX. **YL7C:** YL2MD & YL2GQT. **YM3LZ:** LZ2CJ, LZ2FV, TA3J, TA3D, TA3YJ. **YT7P:** Milena, Ales, Gigi, Srki. **YZ7A:** YU7CM, 4N7CC, Lacy, Tibi, Fero. **Z3ØM:** Z31GX, Z31JA, Z32XX, Z31GB, Z32PT, Goko, Zoce, Boko, Igor.

Station Operators Multi-Op Multi-Transmitter

4M4X: YV5BY, YV5AMH, YV5ANF, YV5EED, YV5FAA, YV5IQJ, YV5IVB, YV5LMW, YV5MHX, YV5NYS, YV5OHW, YV4G. **4ØØA:** YU1IG, YU1JW, YU1ZZ, YU7AV, YU7BW, YU7GW, YU7JX, YU7KW, YU7NU, YT7KF, YT7TY, YT7WA, 4N7DW, 4N7ZZ, Attila, Dusan. **7S2ØØØM:** SM7RME, SM7SMS, SM7TKR, SM7TZK, SM7UGE, SM7URQ, SM7VGQ, SM7VKX, SM7VTX. **9AY2K:** 9A5W, 9A3GW, 9A7R, 9A2R, 9A2EU, 9A2TS, 9A2SD, 9A3SC, 9A3HX, 9A6A, S51R, 9A9A. **A61AJ:** A61AJ, WØUN, WB6ACU, DL2CC, K3EST. **AD4TR:** AD4TR, WB2WIH, KE4JZT, N4AOE, KB2SFA, KC2SFA. **AM4RAX:** EA4TZ, EA4ABW, EA7CD. **AN4URE:** EA2TV, EA4BPJ, EA4BT, EA4CT, EA4ET, EA4TX, EA5DWS, EA5RM, EA5XX, EA7JB, EA7JX, EA4KA, EA4UA, EB4AKI, EB4EPJ. **AN6IB:** EA6QB, EA6FB, EA6AEE. **DLØMA:** DL1IAO & DL2MEH. **DLØWW:** DK3GI & packet. **DX1DBT:** Club Group. **DX1E:** 4F1EJD, DY1FDD, DU1RSM, DU1NUF, DY1FYU, DY1KXF. **ES5Q:** ES2RR, ES5TV, ES5RY, ES5MC, ES5RW, ES5QX, ES5MG, ES5QA, ES5RP, ES5RN. **HG6Y:** HA2NA, HA3OV, HA6DX, HA6OI, HA6OB, HA6OY, HA6ND, HA6ON, HA6PX. **JA1YPA:** JA1PEJ, JM1NKT, JH1AEP, JH1FDP, JN1HOW, JS1XIC, JO1CRA. **JA3ZOH:** JI3OPA & JR4ISF. **KØAB:** AAØRS, KRØU, NØZM, KØEV, WA5JTI, WØDM, WØZA, N2IC/Ø, KØDE, W5GR, KDØOM, KCØEXR, KØMP. **K2BM:** N2NC, N2RM, K2BM. **K3DI:** W3OQ, WAØQII, K3DI. **KI7Y:** W7RM, K7NT, K1TA, KR7X, KK7GW, N6MJ, K7ZUM, K7GDN, W7WZ. **KL7RA:** KL7RA, AL7AF, AL7IF, AL7MU, KL7AC, KL7TC, KL7XD, NL7Y, WL7GF. **KM3T:** KM3T, KC1XX, KB1AWE, K1GQ, K1EA. **KT8X:** K8CC, K8GT, KC8FXR, KT8X, KU8E, N8VW, N8NX, W8MJ, WD8S. **LU1HYW:** LU1HN & LU2HJ. **LU4FM:** LU1FAM, LU1FZR, LU1FGZ, LU1FGE, LU2JCW, LU3FP, LU3FR, LU3FCK, LU3FRV, LU4FPZ, LU6FWV, LU6FUQ, LU6FFQ, LU8FCM, LU8FPT, LU8FQQ, LU8FDZ. **LY7A:** LYR-346, LY3IT, LY2OC, LY3HK, Antanas, Vitalijus, LY3DA, LY3HD, LY3RJ, LY2KJ, LYB-26, LY2NLL, LY2UF, LY2BUE, LY4AA, LY2BMX, LY2KZ, LY2NK. **M5W:** GØMTN, MØCOK, MØCOP, G6KMQ, GØEYO. **NE6N:** W6EEN, K6XC, W6AQ, N6RT, W6SR, W6ORD, PA5AT, SMØJHF. **NK7U:** NK7U, K7ZO, K7MK, W7ZRC, KD7DPD, KD7CB. **NQ4I:** NQ4I, W4DD, NA8V, K2UFT, NE4S, K4PK, N4FD. **NR6O:** N6RO, N6IG, N6BV, K6AW, K2KW, KA6BIM, WA6O, AEØM, K6EP, KR6EF, K6CTA. **OE2S:** OE2VEL & DL6FBL. **OH1N:** OH1BOI & OH1NAD. **OK1KCI:** OK1DUO, OK1CDJ, OK1CPU, OK1DOZ. **OL7W:** OK1DUT, OK1FUT, OK1VBA, OK1TA, OK1HPW. **OTØA:** DF3TJ, DJ7EO, K1WY, ON1AEI, ON1AWB, ON1CIM, ON1DEL, ON1DIB, ON1DJU, ON1DLH, ON1DLJ, ON1DQK, ON1GL, ON4AJW, ON4AMX, OM4ASB, ON4AVM, ON4AWH, ON4AWU, ON4AWV, ON4BCB, ON4CAT, ON4CCL, ON4CCM, ON4CDC, ON4CDE, ON4CHO, ON4CJQ, ON4DB, ON4FG, ON4FI, ON5CD, ON5DH, ON5OT, ON5UM, ON5WL, ON6HZ, ON6NL, ON7PU, ON7AW, ON7HU, ON7NB, ON7VU, ON9CFB, ONLØ3245, ONL1Ø361, ONL1Ø362, PA3EZL, PA7BT. **P3A:** RA9JX, UA9XMG, RVØAU, UT7QF, UA9CDV, UA9CKP, RZ9UA, UA9MA, RAØAM, UA9YAB, YT6A, YT6T. **PI4COM:** PAØRRS, PA1MRK, PA1ZX, PA3CAL, PA3EWP, PA4EA, PA5ET, PA5GV, PA7DD, PA7FM, PE1HWO. **PY3MHZ:** PY3ACC, PY3ADY, PY3AFS, PY3BM, PY3BZA, PY3FOX, PY3MM, PY3PAZ, PY3YY. **RU1A:** RV1AW, RW1AC, RX1AA, UA1ABR, Alex, Dima. **S52Z:** S51TA, S53BB, S53BU, S53CC, S53MM, S53RM, S53WW, S53ZO, S55OO, S56A, S57MW, S59KW. **SY1D:** SV1DKR, SV1DKL, SV1DZB, SV1DNW, SV1DZB, SV1DNW. **UN4L:** Club Group. **UN7LT:** RN9AO & UA9BA. **VE5RI:** VE5BAP, VE5CEM, VE5CMA, VE5FF, VE5FN, VE5RMO, VE5WI, VE6EZ, VE6FN, VE6FW, VE6HMG, VE6VAC, VA7CC. **VE6FI:** VE6FI, VE6LB, VE6AQ, VE6PY, VE6NA, VE6ZA, VE6JAG, VE6NWR. **W4MYA:** WX3B, AC4OB, N4DEN, N4EHJ, N4ZJ, W4DR, W4HJ, W4HZ, WA4QDM, WK4Y, WU4G, W4MYA, Lilly. **WL7E:** WL7E, KL2A, KL9A, KL7FH, WA2GO, NL7Z, NL7RT, KL7CC. **ZW5UF:** PY5BF, PY5ZT, PY5JO, PY5TJ, PY5MHC. **ZX5J:** PP5JR, PY5EG, PP5WG, LU6ETB, ZP5AZL, LU1HF, PY4OY, K1ZM, PP5UA, PY2KC, PT7YV, PY5ZBU, PY5EJ.

(Continued on page 121)

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Kenwood's new DC-light transceiver wasn't even on store shelves yet when CQ Contributing Editor WB6NOA got to play with it for a few hours ... not long enough for a full-scale review, but here are Gordon's first impressions (he was impressed)...

CQ Sneak Peek:

The Kenwood TS-2000 HF/VHF/UHF+ Transceiver

BY GORDON WEST,* WB6NOA

The Kenwood TS-2000 is a futuristic-looking, high-frequency, plus very-high-frequency, plus ultra-high-frequency, plus microwave (as an option), 12 volt DC transceiver for base or mobile operation. If you presently own any late-model, full-size Kenwood mobile, such as a TS-430/440/450, you will be pleased to know the new TS-2000 will slip quite nicely into your present mounting bracket. The TS-2000 is only 2 inches longer. It is the standard 11 inches wide by 4-1/4 inches high, by a slight 14-1/2 inches long, and weighs about 17 pounds.

The Kenwood TS-2000 transceiver transmits on all high-frequency bands with a measured output power of over 120 watts, plus 100 watts on 6 meters, a powerful 100 watts on 2 meters, 50 watts on the 430 MHz to 450 MHz (70 cm) band, and 10 watts with the optional 1.2 GHz band unit installed. It is a powerhouse on the air!

I had only a few hours to run the preproduction check set through tests on the bench and in the mobile, and I'll share with you just a few of the many surprise features I found by working over the new-style "swept face" controls. The display is a bold-readout white and black LCD with four levels of nighttime brightness. The display also offers 16 variations of contrast, and you can see it at extremely off-center angles. The front panel is illuminated with panel-key illumination that may be turned on or off. Working this set in the dark is certainly aided by the back-lit keys, but you still will need to keep an external light handy to identify the panel functions beside the left-hand numbered keypad. All of the other keys go by the description printed right on the keys for easy nighttime use.

Kenwood's TS-2000 is the company's first entry into the all-in-one HF/VHF/UHF ham rig competition. It is likely to make a very big splash! (Photo courtesy Kenwood USA)

Our review unit had the optional VS-3 voice synthesizer installed, and it promptly greeted us with an announcement of which VFO we were on, frequency, or maybe which of the 300 memory channels into which we were currently tuned. The voice synthesizer will also identify menus, submenus, and settings, a very handy feature for the visually-impaired ham.

If you are a Kenwood owner, many of the buttons and knobs will be familiar to you. You have volume and squelch on the two right lower knobs, one for the main ban, and one for the sub-band. I usually start out my reviews with the sub-band volume turned down, just to get the feel of the main band. On the left-hand lower front are two knobs that may increase or decrease the value of the DSP filter cutoff frequency, with values showing on the sub dot-matrix display. It takes only a few minutes to relearn where the volume control is, and you will find that the high-performance, true IF-stage DSP on the main band, plus AF-stage DSP on the sub-band, truly will let you tune into pleasant-sounding QSOs.

A Mind of Its Own?

I was tuning around on the 20 meter band and all of a sudden the radio

*2414 College Drive, Costa Mesa, CA 92626
e-mail: <wb6noa@cq-amateur-radio.com>

began to do things with a mind of its own. It turns out that Clifford Uyeda and Leo Fahmie of Kenwood had left the sub-band on a local 2 meter packet cluster frequency, and Julian Frost, N3JF, doing button pushing with me, put us into the active TNC mode. One minute I was tuning around on 20 meters, and the next minute our local southern California packet cluster squawked 6 meter DX on 50.203, VE1YX coming in double-hop or F2 from Nova Scotia.

Instantly my main band jumped up to 6 meters and got me to my 6 meter beam on antenna port #2. All I needed to do was throw in my callsign once after the pile-up subsided, and I worked some 6 meter DX that I might have missed without the built-in terminal node controller for packet cluster, APRS, and attended Sky Command operation, along with the built-in RS-232 port for complete computer control. However, no computer is required for the built-in TNC and DX packet cluster automatic tuning!

The built-in TNC defaults to 1200 bps, but has capability for 9600 bps. If you don't want the Packet Cluster tune mode to accidentally interrupt you in the middle of a high-frequency, main-band contact, you can turn it into the manual mode and listen to a Morse Code or voice announcement of the rare DX callsign that comes over the cluster. Of course, you could always search out the DX the old-fashioned way by turning off the Packet Cluster auto-tune mode.

The swept front panel of the TS-2000 is designed for ease of use, with frequently used buttons clustered around the main tuning dial. The two dials next to the microphone connector are used to adjust the DSP filtering. (WB6NOA photo)

Lots of Antenna Options

The Kenwood TS-2000 features a built-in automatic antenna tuner, which works from 160 through 6 meters. Like all built-in automatic antenna tuners, it will help flatten out a relatively resonant antenna system, but it is not designed to operate at extremely high SWRs when trying to jam a signal into a long wire or non-resonant load. For that you need the external automatic antenna coupler that mounts up at the antenna feedpoint and is fed off of the alternate selectable HF antenna output jack. This means you could use the built-in tuner for your beams and loops to antenna jack #2 and an external antenna tuner to antenna jack #1, where the internal tuner will be automatically bypassed. You can set up all of this in memory and have the equipment always go to the right antenna system for you on high frequency.

Six meters uses either one of the HF SO-239 antenna jacks, with 2 meters using a separate UHF (SO-239) antenna jack, while 430 MHz and the optional 1.2 GHz use two additional "N" style antenna jacks.

Since we're examining the back of the 2000, it takes the same 6-pin power plug as all other Kenwood and ICOM radios use, and the way the plug is wired, there is no way you can jam it in backwards. There are also jacks on the rear for an external HF receive antenna; a 7-pin remote plug for hooking up HF amplifiers; a 13-pin DIN connector if you want to try your own TNC or RTTY system; two external speaker jacks; two separate jacks for key or paddles with a built-in automatic keyer; a ground lug; external antenna tuner control; a telephone-style jack to separate-out the head or add the little mini controller head the size of the present Kenwood TM-D700 (small!); and a 9-pin female RS-232C comm port connector which would allow you to operate this equip-

The right-hand side of the TS-2000 front panel includes controls for choosing between main and sub tuners, split-VFO operation, etc. Note the satellite button, which activates tracked tuning of both VFOs, and the "TF-SET" button, which allows you to listen to your transmit frequency during split-frequency operation. (WB6NOA photo)

The built-in TNC may be used to monitor your local Packet Cluster, automatically report DX "spots"—such as VE1YX on 50.203.10 MHz in this case—and even switch your main VFO and antenna to the selected frequency. (WB6NOA photo)

ment as a "black box" off your computer. Wow!

On the Air

The main band control takes you up and down on all of the ham bands, automatically getting you into the proper sideband mode when operating on HF at initial turn-on, and going to FM on 2 meters and 440. On these bands the Kenwood also may automatically select positive or negative repeater offsets. When you spin the main band dial through the 2 meter and 440 bands, you regularly will hear beeps and see the offset shift to positive or negative.

For VHF and UHF weak-signal work we use upper sideband and CW down on 144.300 and below, and upper sideband on 432.100 MHz, plus a combination of upper and lower sideband when working most satellites. In other words, even though the unit initially may go to FM on 2 meters and 70 cm, there are plenty of frequencies on these bands where you'll get to exercise the CW and SSB modes as well.

Now that AO-40 is up, you can enter the satellite mode and have complete control of ten satellite memory channels with adjustable frequency function to compensate for Doppler shift. You work a satellite, as we did on Sunday, by using both the main band and sub-band (most ham satellites operate on two bands, one for uplink and one for downlink), and you could adjust the sub-band display uplink frequency just by tuning the RIT/SUB control. In the normal mode, as we would adjust the downlink frequency, the trace function automatically changes the uplink frequency so that the sum of the two frequencies is kept the same. A quick push of the TF/ SET button allows us to monitor our own transmit frequency, ensuring we're not trying to call right on top of another station we might not be hearing on the downlink.

We also saw that we could name each satellite memory channel using up to eight alphanumeric characters. This allows us an almost no-brains recall of all of the satellite activity going on with the new AO-40 just coming up on the air.

When working the main band and sub-band on VHF and UHF frequencies, we found that the main band pulls in additional band-pass filters to minimize out-of-band interference. On 2 meters the main band will tune from 142 MHz to 152 MHz, and on 70 cm it tunes from 420 MHz to 450 MHz. Don't worry, scanner enthusiasts, as there is plenty it tunes in on the sub-band receiver: 118 MHz to 174 MHz: AM aircraft and FM; 220 MHz to 512 MHz: AM & FM.

I was surprised to find some military aircraft AM activity in the middle of the 300 MHz band, and there was plenty to listen to up on 460 MHz, plus plenty of International Space Station NASA retransmissions down on our 222–225 MHz ham band. The sub-band receiver does not tune SSB signals.

The front-panel meter is an LCD type and it features a built-in SWR check from HF up through 6 meters. There is no SWR check on 2 meters, 440 MHz, or 1.2 GHz.

When you select SWR, the meter goes full-over before you transmit, indicating you are now looking at measuring SWR. As soon as you squeeze the mic, the SWR bar graph disappears and then fills in with your actual transmit SWR. When you release the mic, the SWR again goes to the peg. Until you understand how to read the meter, you may think you are transmitting into one heck of a mismatched load. What the meter is *not* showing on receive is a memorized transmit SWR value. Same thing with RF output, ALC, and compression; I would much rather see these indications left blank on receive and only show an indication on actual transmit.

Here's something that I have not seen before—a transverter frequency display that might work on AO-40 when you're working the new satellite up in the microwaves with an external transverter. You can actually calibrate the transverter's operating frequency onto your main display. Kenwood was certainly thinking ahead on this one!

Receive Features

On receive, the auto notch filter worked terrific on 40 meters. It would almost instantly take out any single heterodyne tone. You can even adjust the speed at which the auto notch filter can track a varying tone or go in and do it manually!

The Kenwood 2000 also has a pleasant noise-reduction function—pleasant meaning that going into noise reduction doesn't sound like the audio is coming out of a tin can. Noise reduction #1 uses an adaptive DSP filter to reduce the noise element on the band, and NR2 allows you to vary the noise-reduction time constant. There is also a noise blanker to take out ignition pop, and it offers levels of noise blanking from 1 to 10 with a default of 6.

The pre-amplifier did a terrific job of bringing signals up out of the noise. During the band opening on 6 meters, Leo and I discovered that the DX signal "in the soup" was cleared up dramatically by turning on the low-noise pre-amp. The signal was quite usable after the pre-amp was turned on, although I didn't see quite as much signal level on the S-meter as I currently get with my Kenwood 570. However, the pre-amp certainly works well.

Julian, N3JF, loves CW, and he quickly found the CW memory keyer.

YAESU

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He could select auto-weighting or any type of weight ratio he desired. Storing CW messages in the memory was a snap, and a little bar graph keeps track of how much of the memory is full. This is truly a contester's dream rig, without the need to drag along your entire external computer.

When we took the equipment mobile, everyone liked the sound of our transmit signal. We could even tailor the highs and lows on transmit. And for you AMers, yes, it has both wide as well as slightly more narrow AM capabilities, too, on HF. I'll meet you on 10 or 6 meters in about the middle of the band!

Probably the most exciting aspects of this rig are its relatively small size, no need for an external computer, along with the capability to bring it in as a black box and control it *entirely* from your personal computer. Or maybe order it with the regular head and body, but bring in the optional tiny mobile remote control head and take it out of the house and run it in your vehicle. As I mentioned before, the remote-control head is the same size as the Kenwood 2 meter/440 FM mobile head!

There are probably ten times as many features on this rig than I discovered in just the few brief hours I had to play with it on "DX Sunday" to prepare this article. The entire instruction manual will be posted on the Kenwood website (<http://www.kenwood.net>) soon after the radio is available for sale.

The rear panel of the TS-2000 has four antenna connectors, two (on the upper left in photo) for HF and 6 meter antennas, an SO-239 for 2 meters (top right), and an "N" connector for 432 MHz. Note also the separate rear-panel inputs for a hand key and for keyer paddles, plus a connector for a separate HF receive antenna. (WB6NOA photo)

Pricing will probably start out close to the TS-2000 model number—around $2000. I am told that availability will be just about the time you are reading this in *CQ*. I recommend you go down to your local radio dealer and give it a spin. Push some buttons, and then sit back and think of how one black box with a detached big front head could do triple duty—on your computer, at your shack, or in the mobile. The Kenwood TS-2000 is certainly a contest rig without the external computer, yet not so intimidating that it couldn't be your first choice when getting started on the worldwide bands plus VHF and UHF. ■

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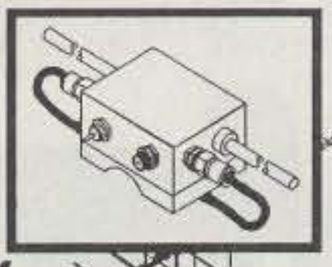

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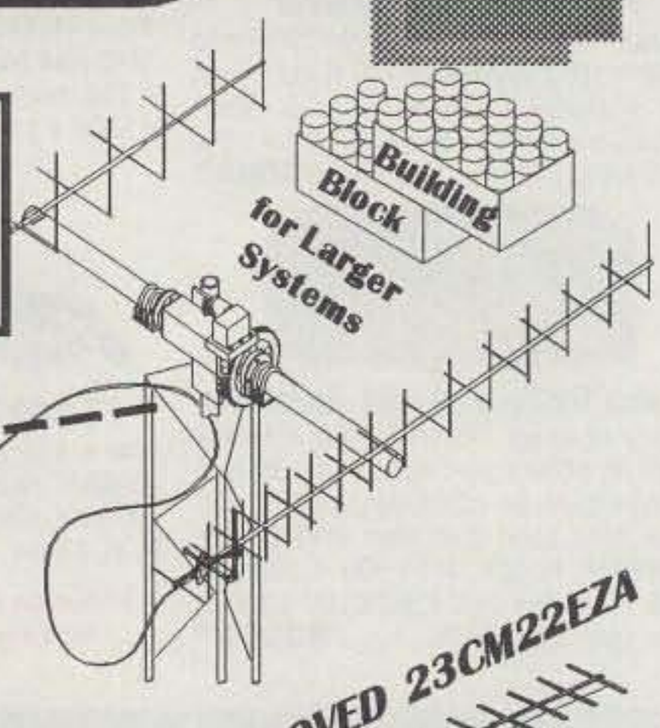

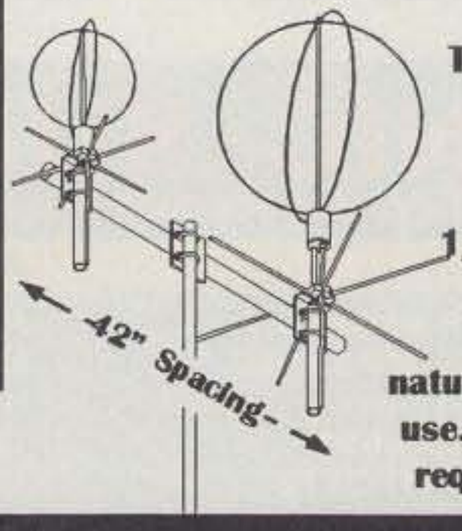

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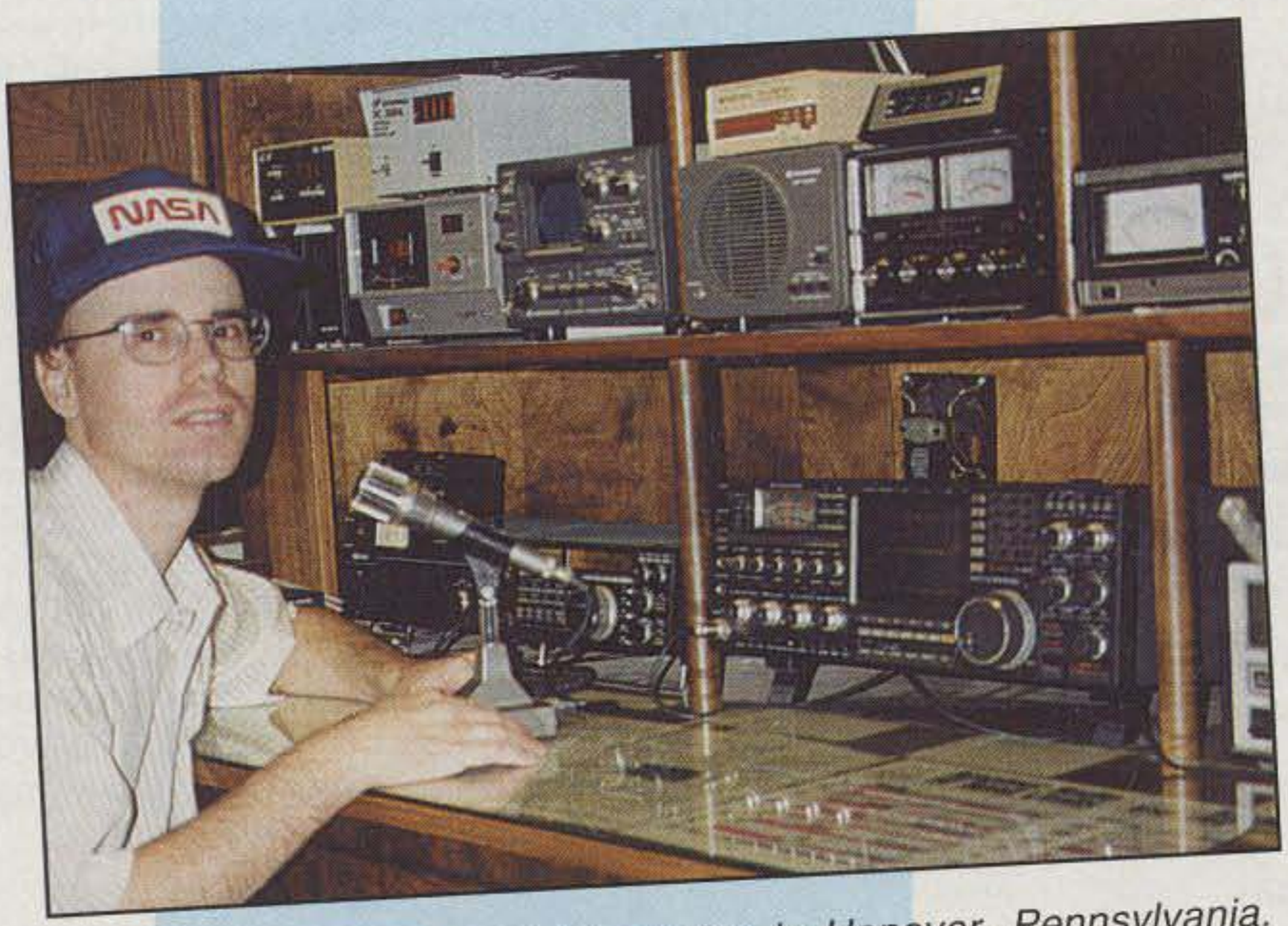
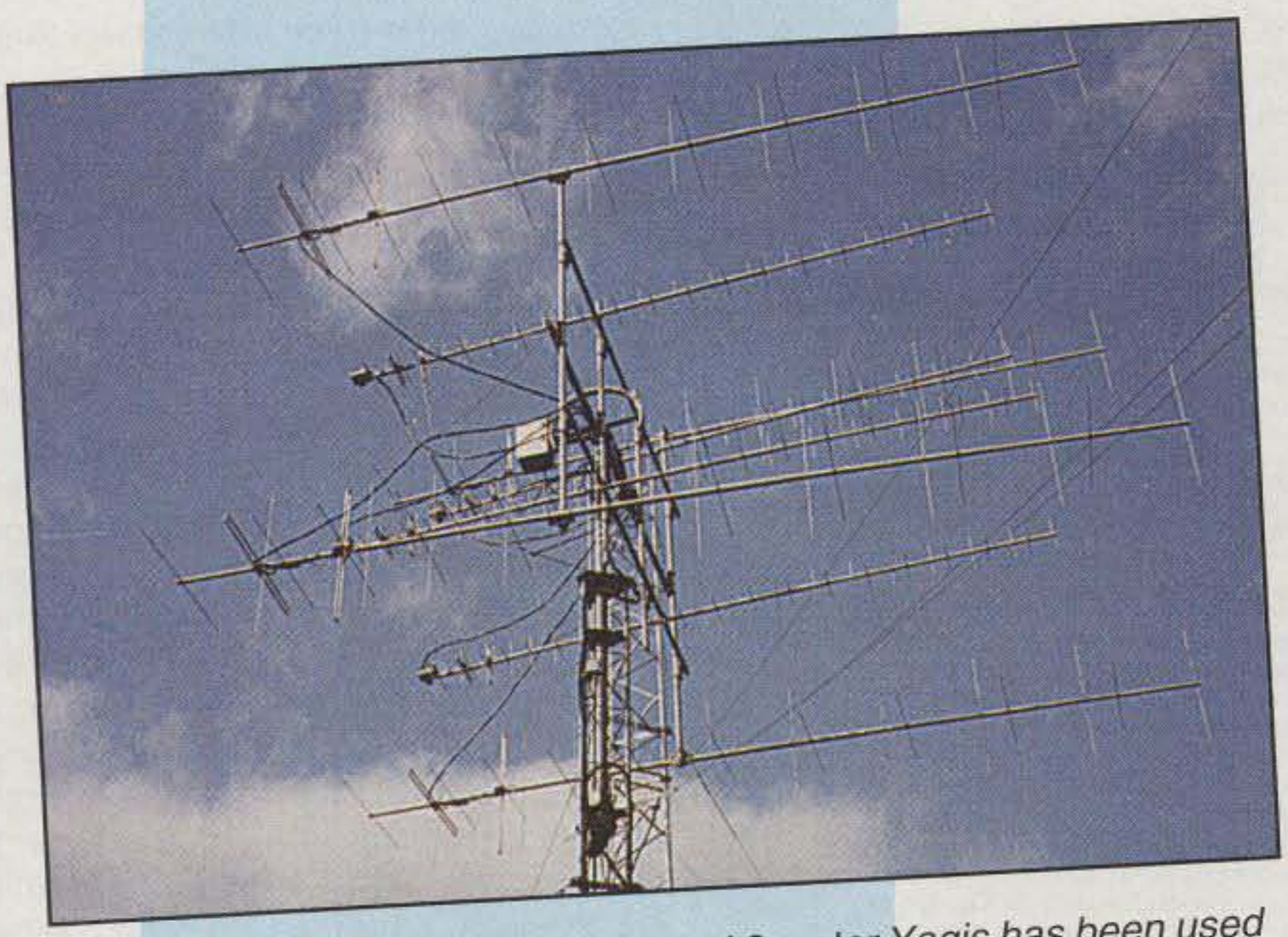
The contact lasted only 26 seconds, but it's sure to be remembered far longer than that by KG3N... as it was the first random ham contact from the International Space Station.

A Very Special QSO

BY RANDY SHRIVER,* KG3N



Randy Shriver, KG3N, at his station in Hanover, Pennsylvania. Shriver made the first random contact with the international space station Alpha on November 13, 2000. (Photos courtesy of the author)



KG3N's antenna array of four stacked 2 meter Yagis has been used for the last 15 years to make contact with fellow hams in outer space. The photo also shows antennas for higher frequencies, used in satellite contacts.

"Randy, you are my first contact from space station."

The static-y voice belonged to Bill Shepherd, KD5GSL, Mission Commander of Expedition One aboard Space Station Alpha. ARISS (Amateur Radio Aboard the International Space Station) was on the air at last, and I was incredibly happy and proud to be at the other end of that brief pre-dawn QSO on Monday, November 13, 2000.

While my contact with KD5GSL was the first random ham QSO from the space station (there had been three previous contacts with ham clubs at various space facilities to conduct engineering tests), it was not my first time contacting a ham in outer space. In fact, I've been doing it for more than 15 years, starting with a 1985 QSO with Astronaut Tony England, WØORE, aboard the Space Shuttle Challenger. I've also contacted hams on the Russian Mir space station, and other shuttle crews when SAREX (Shuttle Amateur Radio EXperiment) was in operation.

One of my most memorable shuttle contacts was during mission STS-50, when Ken Cameron, KB5AWP, answered my call and asked, "What are you putting out there!?" I not only gave Ken a brief description of my station, but was also able to send a slow-scan TV picture of my antenna array up to Space Shuttle Atlantis!

Aiming for the Stars

My station is built around space communications, although I enjoy terrestrial contacts as well,

**209 South St., Hanover, PA 17331*
e-mail: <kg3n@netrax.net>
*** A RealAudio recording of KG3N's contact with KD5GSL, excerpted from Newsline #1226 dated December 2, 2000 (and provided courtesy of Newsline), may be downloaded from the CQ website at <ftp://ftp.cq-amateur-radio.com>. Look for the February 2001 issue and download filename shriver.rm.*

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If you have questions or want to discuss something that's on your mind, join the Forums on the *CQ* website. You can post questions or comments on a variety of topics and get responses either from *CQ* editors or your fellow readers.

To reach the forums, point your browser to the *CQ* website, <http://www.cq-amateur-radio.com>, click the button on the left that says "The CQ Forums," and then select your forum of interest. Currently we have "Q&A," "Webmaster," "DXing," "Public Service and Emergency," and "Beginner's Corner." You may read current messages, post a reply, or open a new topic within each forum. If there's another forum you'd like to see, talk to us about it. Be careful, though … we might make *you* the moderator!

New From LDG Electronics
The World Leader in Digital Autotuners

The RT-11 Remote Mounting Autotuner

The RT-11 is a compact tuner mounted in a water resistant ABS plastic enclosure. The Autotuner was designed with remote mounting in mind, including mobile, marine, tower, or any application requiring a remote mount. The RT-11 tunes most coax fed antennas such as dipoles, beams, and verticals. The RT-11 will operate with power and control signals supplied by Icom and Alinco radios via an optional cable. The new RT-11 design also expands the tuner to cover 6 meters.

Specifications:
- Water Resistant Enclosure
- Microprocessor Controlled
- Tunes 1.8 to 54 MHz
- Matches Antenna SWR of 10:1 (3:1 on 6M)
- Tunes in .1 to 5 Seconds (3 Average)
- Flange Mounting Brackets
- 5 to 150 Watts
- Optional Remote Control Head
- Optional Icom or Alinco Cable (15')
- Optional External Balun Allows Tuning of Random, Long Wire, and Other Antenna Systems

RT-11 Autotuner
Assembled: $209
Kit: $179
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Kit: $29
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Assembled: $15
Balun
Assembled: $30
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including contesting on both HF and VHF. In 1985 I designed and also built an array of four KLM 22c 2 meter Yagis specifically for making SAREX contacts. I used this array, along with an ICOM IC-275H, for my space-station contact. This is actually my "small" antenna. Last year I put up an array for 2 meter tropo and EME (Earth-Moon-Earth) consisting of eight Cushcraft 18-element antennas in a 2 wide by 4 high configuration on an 80 ft. Rohn 80G tower. This array weighs 800 lbs. For HF I'm using a Hy-Gain TH7DX.

As soon as I learned that amateur radio would be part of the ISS from the very beginning, I started making plans for a contact. Once the crew was safely aboard, I used STS-Orbit, my satellite tracking program, to track every orbit. After learning that the crew had hooked up the radio equipment over the weekend of November 11–12, I began listening whenever the tracking program said they'd be above my horizon. I waited patiently for them to get on the radio, and finally, just before 6 AM EST Monday morning, I heard them conducting engineering tests with NASA amateur radio stations. They concluded their test at 5:54 AM, and I jumped in, knowing I had only seconds before the space station would drop below my horizon in central Pennsylvania:

"KD5GSL from Kilo Golf 3 November."

"Kilo Golf 3 November, KD5GSL, go."

"OK. Thanks for returning my call. The name is Randy and I'm in Pennsylvania."

"Randy, you are my first contact from space station."

"OK. Thanks for the contact. You are just going below my horizon. This is KG3N, clear."

Just like that, it was over—26 seconds from start to finish, yet one of my most memorable QSOs in 20 years as a ham.**

Will I keep listening? You bet. I'd like to have another chance to chat and hopefully have more time for a longer QSO or to ask a question. And by the way, you don't need a high-powered radio or a monster antenna array to contact Space Station Alpha. Remember, any time the station is above your horizon it's within line of sight and even a handheld should (in theory) be able to get through. Chances are you'll have plenty of company, though. Thus, a little bit of power, an antenna you can aim, a little luck, and a lot of patience should offer the best recipe for success—heavy on the last two ingredients. ■

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Ham radio on the International Space Station has its roots in similar operation from the Russian Mir space station. We thought the following article from the Russian space magazine News of Cosmonautics *(translated into English) would provide some valuable perspective.*

Amateur Radio Communication in Piloted Cosmonautics

BY M. POBEDINSKAYA,* TRANSLATED BY ALEXANDER (SASHA) ETLIN**

On May 17, 2000, as part of a training module for international ISS crews, Energiya (the Russian space agency) held a conference dedicated to the subject "Using the Experience of Psychological Support For Cosmonauts During Long-Term Flights On Mir OC (Russian Space Station) for the ISS Program." I will note that the conference emphasized only one, albeit very significant, factor of psychological support—amateur radio activities on board.

The CN ["Cosmonautics News"] correspondent has her very own callsign, too. I managed to communicate with the amateur radio station on the Mir OC (R0MIR callsign). Because of that I was invited to take part in the conference.

Also participating in the conference were two top Energiya officials; commander of cosmonauts' team (Energiya) G. Strekalov,; commander of cosmonauts' team (Center of Cosmonauts Training) V. Korzun; cosmonauts S. Avdeyev, N. Budarin, P. Vinogradov, A. Lazutkin, M. Manarov, G. Padalka, and A. Poleshchuk (each of them has his own callsign); the management of Bermos Company, which supports amateur radio activities on board the Mir OC; and a representative of AMSAT-R.

Training cosmonauts in amateur radio communication (class scheduled for 40 hours) is officially included in the training program with a mandatory test at the end. It has two phases: The first phase trains them in the basics of amateur radio communication at the Gagarin Center for Cosmonaut Training. The second phase, and the test for main and back-up crews, is provided on the basis of the club radio station (callsign R3K) at the Energiya on a simulator.

A group of ham-cosmonauts gathers for the opening of the amateur radio club station at Mission Control, Korolev, Russia. Standing behind the desk with the arrow pointing toward him is Sergej Samburov, RV3DR, who is responsible for putting more amateur radio satellite projects into space than any other individual. Equipment on the desk highlights several MIR projects. (Photo via WF1F)

Operating from Mir Since 1988

The history of using amateur radio communication at the Mir OC started during the year-long flight by Vladimir Titov and Musa Manarov. During the communication sessions, the cosmonauts shared that while flying over Europe and America they heard outside radio talk on their service channel. Musa Manarov contacted Earth with a request to send on board a radio receiver and an amateur VHF radio station. The Okean radio station/receiver and ham radio literature were delivered to the Mir on September 21, 1988, with the Progress-37 cargo ship, and the antenna on September 18, with the Progress-38 cargo ship. During their space walk on October 20 to fix a Dutch telescope, the crew performed very productively and had time left to set up a radio antenna (the antenna set up was included in the cyclogram of the space walk, with a notation: Provided there is free time.) The antenna was a brass tube, approximately 1 meter long and 10 mm in diameter, engraved with the callsigns of the amateurs who built it (UW3AX, UA6HZ, UK3R, and UZ3AU).

By that time, licenses were obtained for the cosmonauts. The crew com-

** Reprinted with permission from the July 2000 issue of* News of Cosmonautics, *covering Russia's space program. <http://www.videocosmos.com/magazine/exploration.html>*

***Glasnost Communications, Cincinnati, OH*

mander, V. Titov, received the U1MIR callsign; the flight engineer, Musa Manarov, got U2MIR. Doctor V. Polyakov, who joined them on August 30, provided a professional evaluation of amateur radio communication as an excellent tool for psychological support of the crew during a long space flight. He received the U3MIR callsign.

Musa Manarov had the first radio amateur session on October 8, 1988, with the radio station of the *Komsomolskaya Pravda* newspaper (callsign UK3KP), operated by L. Labutin, UA3CR. The news that a radio channel in the range of 144–146 MHz opened at the Mir station was fast to spread among hams of the world. The air literally became jammed with many stations calling out to the MIR while it was flying over them.

Although the very first session of amateur radio communication in space was held by Flight Specialist Owen Garriott, W5LFL, on November 28, 1983, from on board the Shuttle Columbia during the STS09 expedition, communication with the shuttle is not very common. The point is that during their short flights, the American astronauts have to perform an intense research program, and they have practically no time left for such talks. The amateur radio equipment on the shuttle works in the mode of an automated robot, which is not dissimilar to pilotless amateur radio satellites. If American astronauts do have amateur radio sessions, these are, as a rule, very brief talks with the mandatory callsign exchange.

Amateur Radio: Spiritual Comfort

All the cosmonauts had very warm memories of their talks with radio hams during their long space flights, of the spiritual comfort created by an opportunity just to chat, in extreme conditions, about soccer, the weather, movies, etc. The cosmonauts had regular partners in radio talks who communicated with practically every active crew member—Miles Mann, WF1F, and Dave Larsen, N6CO, from the USA; Giannino Bernobic, IV3WLQ, from Italy; and simply Rita, VK3CFI, from Australia.

Permission to start a club radio station at the Energiya was obtained in 1992. It is located in the Flight Control Center. S. Samburov, RV3DR, was appointed the director of the radio station, and Sergei Krikalev, U5MIR (now aboard the ISS), his deputy. Samburov is also the director of amateur radio activities on the Mir and ISS and a vice-president of AMSAT-R. At this station a complete set of amateur radio equipment was set up, identical to the equipment on board the MIR. At present it is an extensive amateur radio complex, including three complex systems: Sputnik 3 – Packet, SAFEX-II, and SSTV, including four radio stations, four external antennas, six packet controllers, filters, duplexers, etc., etc.

At present a second club radio station is being set up at the Energiya, and a simulator is being developed for training cosmonauts to work with amateur radio equipment, which is planned for installation on the ISS. The amateur radio callsign RZ3DZR has been obtained for the Russian part of the international station.

Acknowledgement

Thanks to Farrell Winder, W8ZCF, and Miles Mann, WF1F, of MAREX, for bringing this article to our attention and for arranging translation as well as permission to reprint it. — *W2VU*

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Can antenna gain increase if element spacing is decreased? N4PC says common sense told him no, but experience with the Raibeam showed him otherwise.

CQ Reviews:

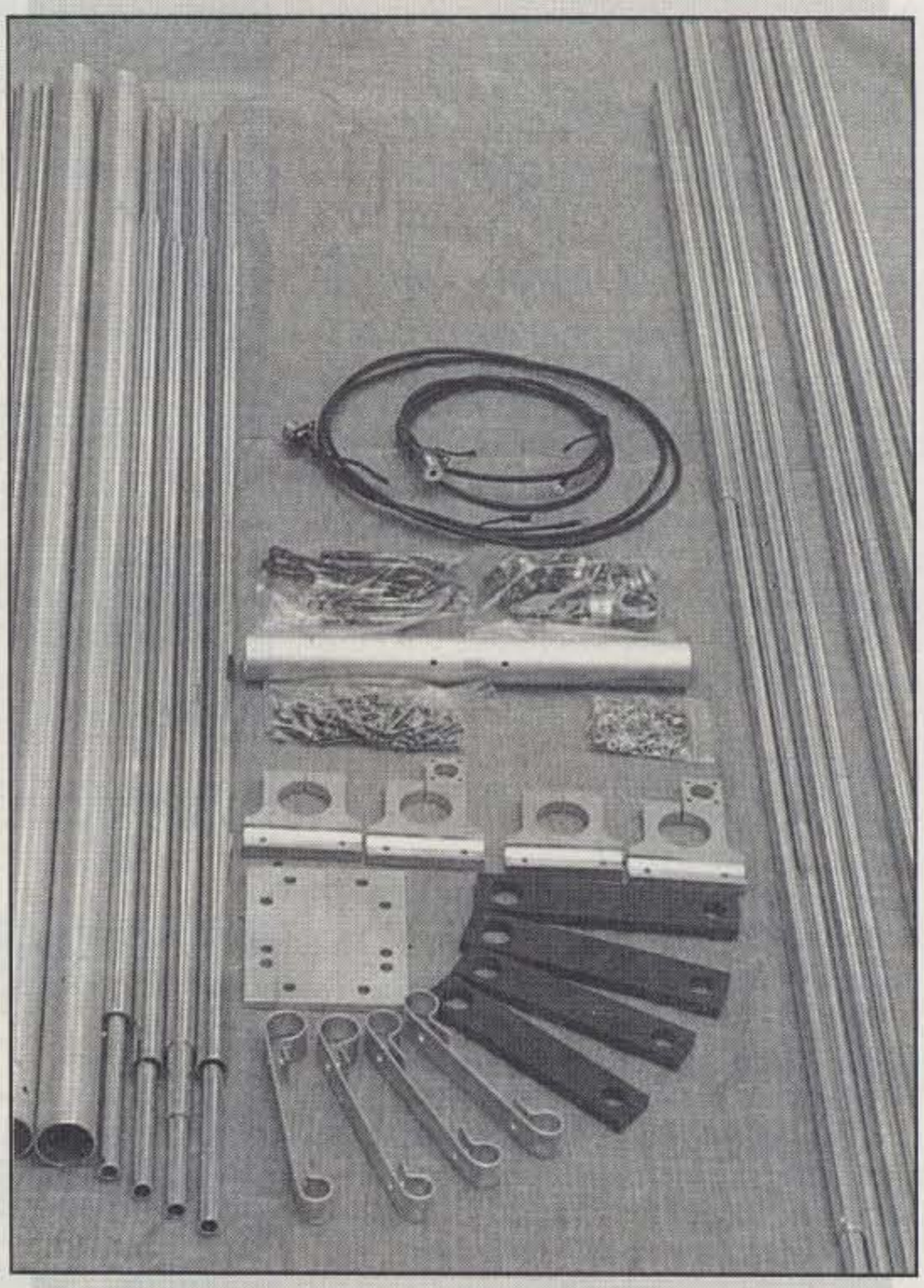
The Raibeam Antenna Model RB 24W

BY PAUL CARR,* N4PC

One of my hobbies within amateur radio is antennas. When I heard Chuck Smith (the originator of the Raibeam antenna), WA7RAI, on 17 meters talking about a new antenna, my attention was piqued. I listened silently and marveled at the great signal reports he was receiving, both on forward gain and front to back. I was further impressed to find that the antenna he was using had only two elements. I was very impatient to find out more details about this particular design. The secret was he had developed a workable super-gain antenna. I was *very* impressed!

My first encounter with the concept of a super-gain antenna was in the book *HF Antennas for All Locations* by L. A. Moxon,G6XN. There were some ideas that seemed unnatural to me, such as the gain could be increased if the element spacing could be decreased. My remark to myself was that would be a neat trick if someone could pull it off. Prior thinking told me that as the elements were moved closer together, the impedance of the array would be decreased, and as a result, the matching problem would become more difficult. Well, I am happy to say that Chuck, WA7RAI, has solved this problem and has won a patent for his efforts.

I was extremely pleased when the editor of *CQ* asked if I would be interested in doing an evaluation of the antenna. The answer was an overwhelming *yes,* and shortly thereafter the antenna arrived at my door. Here is the result of my evaluation



The Raibeam inventory complete and ready to assemble.

Where To Start

The first thing I always look for when I open a package that contains a new piece of ham equipment is the instruction book, and this time was no exception. After the page containing the parts list, I found something that impressed me very much. There was a guarantee stating that the antenna would outperform any Yagi of equal boom length. Of course, the antenna must be assembled in accordance with the instruction manual. That was very impressive to see a guarantee right up front!

The first order of business was to take the parts list from the instruction manual and do a complete inventory. Some of the aluminum tubing pieces were telescoped, and they are not necessarily mating pieces. If you proceed in a logical fashion, you can account for each piece down to the smallest lock washer. A glance at the diagrams in the instruction book at this point is a great help.

After the parts inventory, my friend Frank Andrews, KG4BVS, and I began the assembly of the antenna in accordance with the instruction booklet. Frank is a very skilled machinist, and I valued his comments about the quality of the parts and the excellent machine work on those parts.

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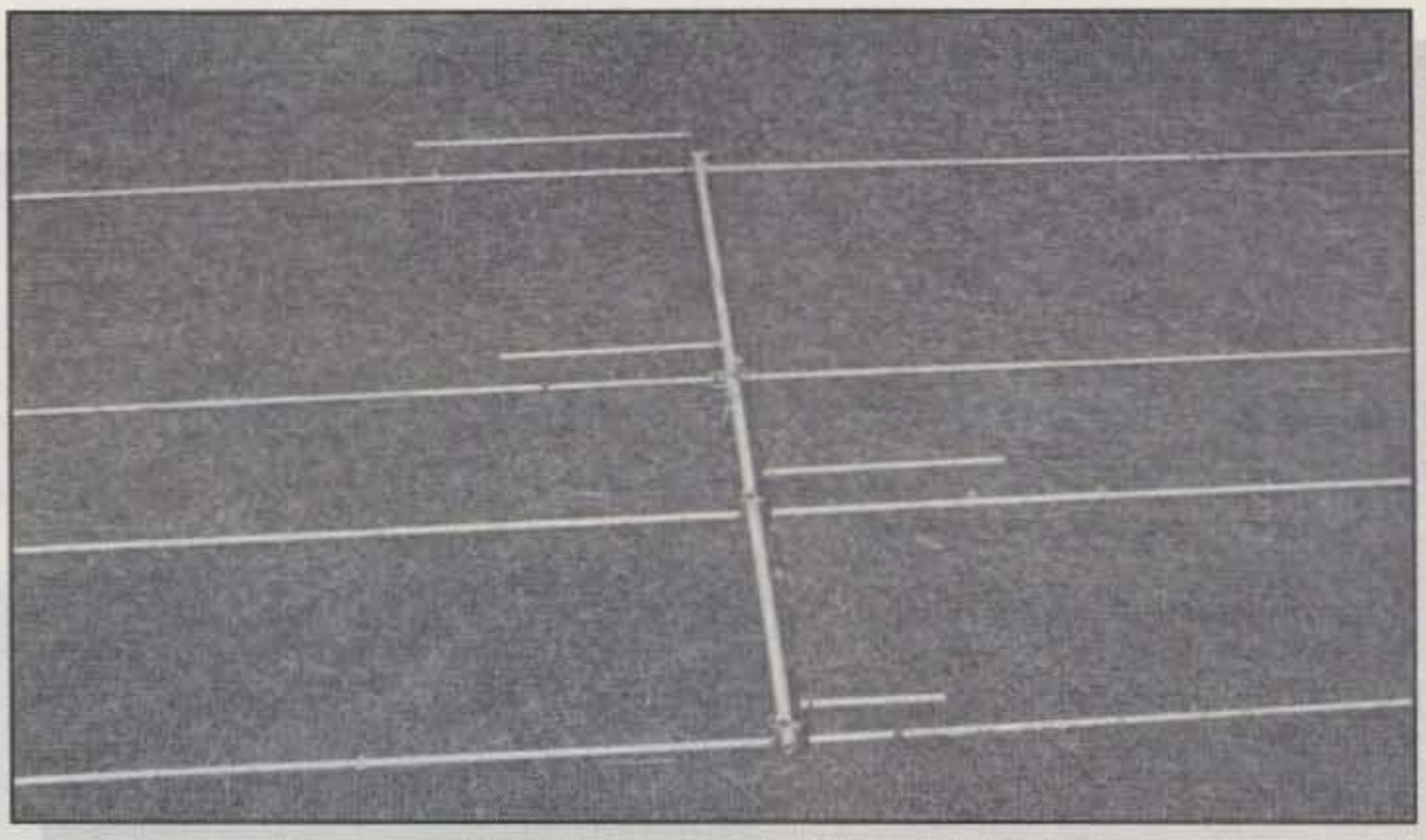
Next Step—The Assembly

The assembly begins with the boom. It was immediately obvious that the material for the antenna was chosen with longevity of the antenna in mind. The boom length for this antenna is 8 feet, but realize that this is actually two antennas on a single boom. If you look at the diagram in the instruction book, you see this is actually two closely spaced antennas that share a common boom. Let me give you a tip that perhaps will save you some time: Notice that the elements for the 17 meter beam are a larger diameter than the elements for the 12 meter section. Remember I remarked earlier about the precision machining? Well, I got the boom-to-element brackets interchanged, which necessitated removing the elements and changing the location of the brackets. The correction was made in short order, but I was further impressed with the precision machine work.



Assembly completed, the Raibeam is ready to raise.

Another item that impressed me with Chuck's attention to detail was the fact that the instructions dictated the application of contact compound where the tubing sections telescope to form the elements. This is a small item, but that told me Chuck wants his antennas to work properly in any environment for a long time.

We are nearing the end of the assembly of the antenna. The next step is to mount the antenna elements and the matching networks. I am always a bit reluctant to think that the lengths for the matching sections are good enough not to require some final slight variation, but I was happy to find that with the antenna at approximately one-half wavelength height, the published dimensions were accurate. It is nice to see a 1:1 SWR appear upon initial installation. After the installation of the phasing lines, double check your work. In my

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particular situation I was fortunate enough to have Frank to look over my shoulder and verify the assembly.

Up in the Air

It was now time to raise the antenna into the air and make preliminary performance checks. As I indicated earlier, this is actually two antennas on a single boom, and as a result two lengths of coaxial cable are required. To isolate the feed system, the instruction manual recommends an isolation network be formed by forming the coax into several turns and taping the coil to the mast.

Since the antenna has a maximum element length of slightly over 28 feet and a weight of 20 pounds, the mast installation is a simple task for a two-man crew. I am fortunate enough to have a tiltover tower and this further simplified the placement of the antenna on the mast. Again, I recommend a final check of all items before the antenna is placed in its final position.

Safety First

Any time there is an antenna to be raised into the air, I think I would be negligent If I did not mention safety. Always check the antenna clearance from all electrical facilities. This is a serious matter. It is also very important to check the clearance from trees and other structures. This is not as critical as the electrical clearance, but serious damage to the antenna can result if you try to rush matters. One carefully calculated step at a time is all that is necessary.

Performance Evaluation

Here is the moment you have been waiting for—the initial evaluation. Having seen the material quality and the forethought that Chuck put into the antenna, I had no doubt that the antenna would be a real performer. I am happy to say I was not disappointed. The initial test was to check the SWR on both bands. With the measurements specified in the instruction manual, the tests were slightly better than the specified. This measurement will vary with height above ground and the location of nearby objects.

The next test was to check the forward gain, front-to-back ratio, and front-to-side ratio. In all cases the antenna met or exceeded all specifications. I used a reference dipole, and it was very nice to hear the comments of the hams during these A/B comparisons.

You may think that my next comment is a bit strange, but I was fortunate enough to have a slight wind storm during the evaluation. I am happy to report that the antenna stayed in the air and was "steady as a rock." I think that mechanical stability is as important as electrical performance. An antenna will not perform very well if it is reduced to a mass of bent aluminum at the base of the tower. In my opinion, Chuck has done a great job on the design and fabrication of the Raibeam.

The antenna I evaluated is the two-band version for 12 and 17 meters. This is where I spend most of my time on the air, but if you would like more information on the other antennas that Chuck has to offer, check his web page <http://www.raibeam.com>. There you will find information on all the antennas plus a short treatise on super-gain antenna theory.

I was very impressed with the Raibeam. I would very highly recommend this antenna to those who want a well-designed structure that is a real performer. The antenna ia available from Raibeam, 857 Park Ave., Brooklyn, NY 11208 (1-888-530-2326). ■

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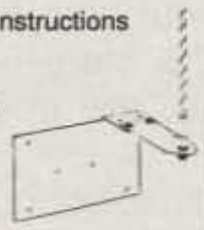

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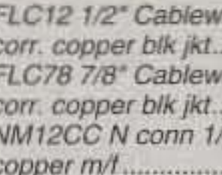

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You may be familiar with "grey line" contacts, but what about "dark line" and "black line" QSOs? Read on for the great DXing opportunities they afford you.

Go Surf the Grey and Dark Lines

The Art of Low and High HF Band DXing Part I

BY STEVE IRELAND,* VK6VZ

A few years ago, when the internet was in its infancy, some people used to talk about "surfing" it. What I am going to talk about here is the only *real* form of surfing there is apart from the original one, the one which uses the sea.

Cruising the safe, predictable, boring highways of cyberspace isn't surfing. Riding the so-called *grey line,* the name given to the line that marks the ever-changing boundary between those parts of the world that are in darkness and those in daylight to make contact with far-away countries using a radio transceiver, now *that's* surfing.

For a moment I am going to go back in time about a year to give you an idea of what I am talking about. Let me take *you* surfing the grey line, and its close relative the dark line, southern hemisphere-style.

Stepping Back in Time

It is a few minutes before sunset, around 7 PM local time (1100Z) on a warm January evening (Don't forget that this is the Australian summer.) and I wander into my radio shack. I turn on the transceiver and carefully check the SWR of my 1.8 MHz bent inverted-Vee dipole before getting started in the CQ World-Wide 160 Meter Contest for the year 2000.

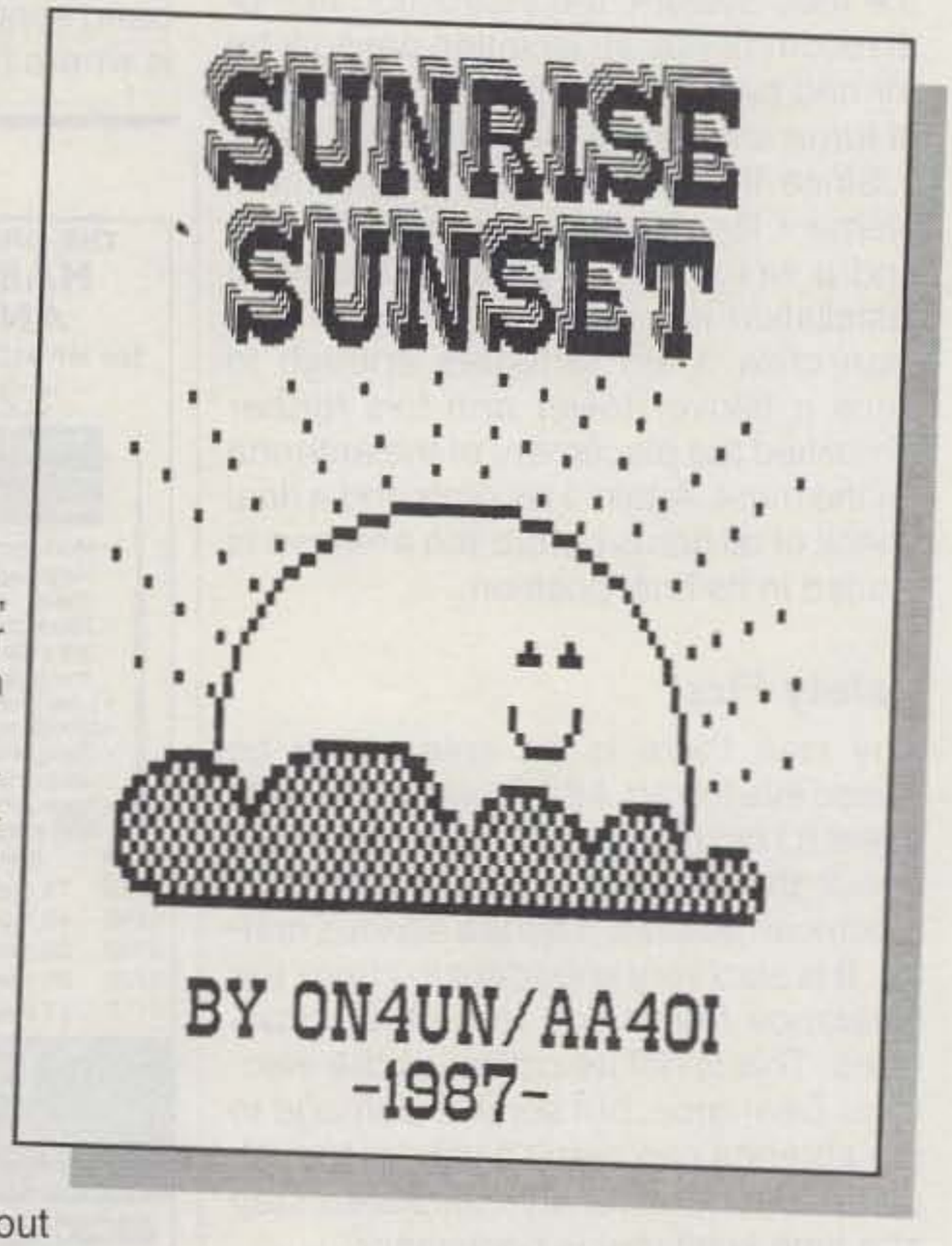
Tuning across the band, the conditions look to be good across the Pacific into North America, and I quickly find and work old friends WB9Z, KH2/K4SXT, and W8JI. Their signals are strong and I am starting to get really excited.

As the last rays of the setting sun touch the shack window, I call CQ TEST on 1.830 MHz. Over 18,000 km away, on the other side of the world, on the far eastern seaboard of the USA, the night sky is lightening with the first rays of dawn. After a couple of CQs, to my pleasure W1FJ calls me from Massachusetts, about readability 5 and strength 6.

We make the QSO, and when I sign, there are four or five stations calling. In quick succession I work stations in eight different states, including New Jersey and New York. This is great! I am having a beautiful time. As the sun comes up in W2-land and the NY and NJ signals start to fade, they are replaced in the pile-up calling me by W3s and W4s.

The stations are going into my logbook at a rate of almost one every couple of minutes, and I am staggered by how loud their signals are —some even up to S9. Stations call from Pennsylvania, Maryland, Virginia, and Delaware. This is just fantastic, and the pile-up is growing all the time.

I take a gulp from the glass of water by the rig, and as the digital clock ticks over to 8 PM, my old 386SX laptop shows 25 stations logged so far. As the sun continues its remorseless progress into the skies of eastern North America, the pile-up increases in size and the grey line moves on.



ON4UN's "Sunrise Sunset" tables contain sunset/sunrise times for over 530 locations worldwide, including 100 locations in the USA.

A VE3 pops out from under the stack of Ws and we work at 1228Z, adding Ontario to the list. As soon as I finish the QSO, there is a wall of callers. By 1245Z I am working mainly W4s, 8s, and 9s. North Carolina is in the log, along with stations from the Great Lakes states—Michigan, Illinois, Indiana, and Wisconsin.

The evening has now turned humid in Western Australia. My T-shirt is soaked with perspiration, and static crashes are beginning to hurt my ears, but still the stations are calling and I concentrate even harder to stay with the pile-up. There is a slew of mid-western stations calling now, ranging from Missouri and Colorado to Wyoming, and I work my way through them. This is just awesome!

**P.O. Box 55, Glen Forrest, Western Australia 6071, Australia*

← *This 1.8 MHz contact with Mike, R1AND, in Antarctica in the middle of the southern hemisphere, is a true grey-line QSO and perhaps VK6VZ's best ever. Owing to high auroral activity, working across the Antarctic region is extremely difficult and R1AND was on the far side of Antarctica from VK6.*

VK6VZ's best 1.8 MHz dark-line QSO is with ZX0F (Fernando de Noronha), superbly operated by Jeff, K1ZM, on 1 November 1999. It is the only zone 11 station VK6VZ has worked on 1.8 MHz and the path between them skirted Antarctica. →

Now daybreak is approaching in the wide-open spaces of the Midwest and the pile-up falls away until there is nothing. I call "CQ TEST" frantically, but when I switch to receive, there are only loud bursts of static. It seems the radio surf has dropped.

I start to listen down below 1.9 MHz, in the old JA DX window, and can hear a swag of Japanese stations. While this isn't exactly grey- or dark-line surfing from VK6, it is still DX and I start working split frequency and soon there are a few JA stations logged. However, at the same time I keep checking 1.830 MHz to see if the radio waves pick up.

Suddenly, "surf's up" and I can hear North American stations again. I quickly transfer my attention back down the band and soon have a pile-up running. Yeee-haaa! Things are slower this time and the surf seems to rise and fall, and the pile-up is much smaller. However, every time I finish a QSO another station calls me. Arizona, Washington, and New Mexico go into the log.

I am beginning to feel very tired now, and part of me wants to stop but I can't. It is just too exciting, and I want to see how long the ride lasts. By 10:30 PM local (1430Z) I am almost dead in the chair and working stations on the western seaboard in California, Oregon, and Washington.

I am so tired that my Morse sending is terrible, but still I go on, although the signals are fading now. At 1445Z I work W7EJ in Oregon, there is a quick surprise contact with VQ9IO on Diego Garcia, and suddenly there is no one calling me anymore. The radio surf into North America has finally dropped away as the sun rises over the northern part of the US west coast.

I just sit there exhausted and look at the computer log in disbelief. There are almost 80 North American stations in there, from 33 different states. I think, "What the heck happened?" and pray, "Please, God, could it happen again soon?"

What happened was that I got lucky (admittedly in a contest), and owing to some very good propagation I was able to surf the grey and dark lines almost non-stop for over three hours, working heaps of DX many thousands of miles away on a band that most use only for local communications. A similar experience back in February 1995 made me a 1.8 MHz junkie (or should I say "surfie") forever.

What I intend to show you in this article is how to get a similarly intense experience on whichever of the lower or upper HF bands is your particular favorite. One important point to make: The kind of experience I described is really not that rare, even on 1.8 MHz. Ask your local Topband DXer! It is simply a matter of being on the right frequency at the right time, having some really good radio propagation, and being capable of riding the radio surf, of course.

The Right Time

Quite a lot of licensed radio amateurs and shortwave listeners operate on the shortwave bands without much thought as to what directions signal are coming from/going to. A lot of us have only a few hours available each week to pursue our hobby, and we simply switch on and take the chance to work whatever we are hearing on the radio at that particular time.

This method is rather "hit and miss" and can lead to disappointment. If you primarily are a daytime radio operator, the upper shortwave bands can be lots of fun for DX during the local winter period, but during summer they often are

only open for intra-continental traffic, particularly during years of low sunspot activity. Similarly, those who are night owls can find the upper shortwave bands lots of fun during the summer but pretty dead in winter, especially, once again, when there are few sunspots.

There is another important, even more obvious propagation pattern to be aware of, obvious even to someone who has only listened on the shortwave bands for a few weeks. As a rule of thumb, those bands below 10 MHz come alive during the hours of darkness, while those above 10 MHz are best during daylight.

There are only two periods of the day when DX is regularly heard/worked on both the low and high HF bands at any time of the year and at (almost) any phase of the sunspot cycle. Yes, you guessed it—at around your local sunrise and sunset. If there are only a few hours each week when you can get on the air, making it around these times is going to bring you the most interesting DX results all year round. After being on the air for nearly 30 years, I can tell you that the vast majority of my radio activity is in the periods before, during, and after sunrise and sunset, in the time when propagation is often termed *grey line*.

What are the Grey And Dark Lines?

When *both* ends of a long-distance radio path are in twilight, one close to sunrise and the other close to sunset, then the mode of radio propagation between the two can be called *grey line*. The term *grey line* was originated by well-known low-band DXers Dale Hoppe, K6UA, and Peter Dalton, W6NLZ, during the 1970s.[1]

The grey line is centered on the *terminator*—the constantly moving line that separates night from day. However, the grey line actually can be considered as a zone,[2] not a thin, quickly moving hard-and-fast line like the terminator around which it centers. The effective width of the grey-line zone depends both on the latitude of your station and the time of year.

If you think about it, the sun rises most quickly for a station on the equator, and for this station the grey-line "zone" will last for only several minutes during its summer. However, for a station near the one of the Earth's poles, during its winter the grey-line zone may last for several hours.

Here in southwestern Australia, I am closer to the equator than the pole, so true grey-line propagation is only relatively short, particularly in summer. However, although this is the case, ironically the effects of summer grey line can be very pronounced—more than I remember when I lived in the northern hemisphere closer to the pole—with good propagation often lasting well after the grey line has moved on. This effect is particularly noticeable on the lower HF bands during summer from VK6.

There are a number of interesting explanations for this which involve signal ducting, chordal-hop propagation, and the focusing of signals at sunrise/sunset, which I will not go into here (but are well worth reading about in John Devoldere's great book *ON4UN's Low Band DXing*—see reference 2 for details). However, the main thing about all of this in my experience is that the good DX conditions experienced during grey-line openings can often last much much longer than the theoretical grey-line scenario would indicate, particularly when signals are propagating to the east after your local sunset on the lower frequency bands.

The width of the grey-line zone during the 1.8 MHz opening I described earlier would only have been a few minutes, yet the signals from North America continued at the same strength for several hours after my grey-line zone had disappeared.

What I am getting it is that although the grey-line zone was gone, signal levels continued to be enhanced for several hours after my sunset as the stations at the other end of the path approached and went through their local sunset. This type of enhanced propagation has been called *dark line* by propagation expert Bob Brown, NM7N,[3] to distinguish it from grey line and *black line* (true nighttime propagation).

Of the stations I worked during the previously described CQ WW 160 Meter Contest experience, only the QSO with W1FJ was a true grey-line QSO (virtual sunset at my end, virtual sunrise

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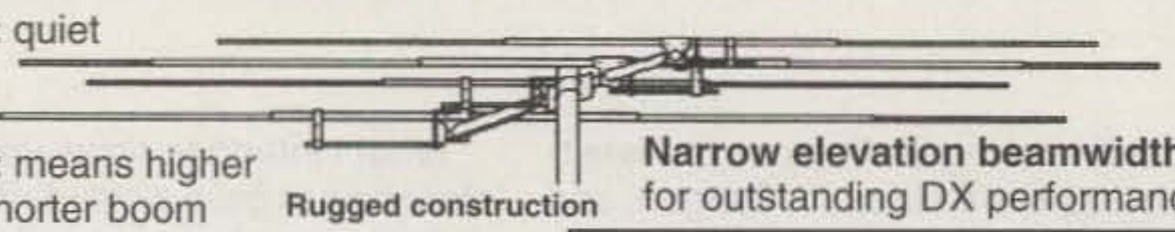

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at his); the majority were dark line (virtual sunset or sunrise at one end), while the JA QSOs were clearly black line (complete darkness at both ends). The farthest/best QSO was the true grey-line one: W1FJ is over 18,600 km (11,550 mi) away from VK6VZ!

All this grey-, dark-, and black-line stuff may sound rather complicated. If so, my suggestion is not too worry too much about actually understanding grey-line or dark-line propagation, but simply first learn how to use it. Like most surfers, my original aim was not to understand why there are big waves, but to ride them for as long and hard as I can while they are there.

There are a couple of important things you need to know if you are to ride the grey and dark lines in this manner—sunrise and sunset times for as many places as possible, especially for your own location, and where the grey line is falling at all times.

Tools of the Trade

One of the first things any radio amateur who is serious about working DX should get is a copy of the sunrise and sunset times for his or her QTH throughout the year. For those who live in or near a major city or state capital city, this is usually fairly easy, as the state astronomical observatory often can sup ply a list.

As sunset/sunrise times effectively do not vary from from year to year, a list for one particular year will last for the foreseeable future, or until the list falls to bits from too much use. My set of tables from the nearby Perth Observatory dates back to 1995, bought just after my "conversion" to 1.8 MHz surfing.

For those who live in rural areas, there are a couple of other possible ways to find out your sunrise/sunset times. Sometimes the local meteorological office or county offices can provide you with a list. If not, ask your radio friends to see if any of them has a software propagation program such as the famous Miniprop.[4] With patience, software of this type can be used to generate sunrise/sunset times for a year, if you are prepared to enter your QTH's latitude/longitude into it and then make separate entries for 365 days! Even if you just work out your sunset/sunrise times for the beginning, middle, and end of each month and make up a table based on this, it will be a great help in surfing the grey and dark lines.

Knowing your own sunrise/sunset times is the first very useful thing you need to be able to ride the radio surf. Knowing the sunrise/sunset times of other countries/states/places you wish to contact is equally vital, as I have already indicated in the description of grey- and dark-line propagation.

ON4UN has pointed out that as a rule of thumb there are *two* propagation peaks for all east to west, west to east, northeast to southwest, and northwest to southeast paths, the first occurring around sunset at the station at the western end of the path (i.e., VK6) and the second occurring around sunrise for the station at the eastern end of the path (i.e., in a North American state from VK6).

For the princely sum of US$10 (plus US$5 for worldwide airmail), ON4UN sells a set of Sunrise/Sunset tables for the various countries that make up the DXCC listing.[5] These tables, in a convenient book, give approximate sunrise/sunset times for each country at the beginning, middle, and end of each month. I bought a set of ON4UN's tables a couple of years ago and soon wished I had bought one when I started grey- and dark-line DXing.

To give you a practical example of how useful these tables are, there is a huge variation in sunset times from the eastern part of the Caribbean to the western part, an area of the world that is hard to work from Western Australia on the low HF bands except under grey-line conditions. You really need to know *exactly* when the local sunrise time is, an easy task with ON4UN's tables. ■

References

1. "The Grayline Method of DXing," by Dale Hoppe, K6UA, and others, *CQ,* September 1975.

2. Chapter 1 of ON4UN's *Low-Band DXing,* published by the American Radio Relay League.

3. "160m DXing" (part 1) by Bob Brown, NM7N, *The DX Magazine,* May/June 1996.

4. Unfortunately, I understand that Miniprop, developed by Sheldon Shallon, W6EL, and its successor Miniprop Plus, are currently unavailable.

5. "Sunrise Sunset" tables by John Devoldere, ON4UN, third edition, published in 1987. His address is: John Devoldere, Poelstraat 215, B9820 Merelbeke, Belgium. Check availability and prices of the tables by e-mailing him at: <john.devoldere@pandora.be>.

In part two of "Surfing the Grey and Dark Lines" Steve Ireland, VK6VZ, describes how to practically exploit these modes of HF propagation in the 1.8 to 30 MHz HF spectrum.

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Anything connected to power lines, including all of our ham gear, poses a risk of fire. W6BNB, a former fire chief and author of a firefighting manual, offers important advice on preventing ham-shack fires and how to react if a fire does break out.

Fire in the Ham Shack!

BY BOB SHRADER,* W6BNB

In any ham shack there is always the possibility of a fire starting. Whenever there is electronic equipment connected to power lines, according to old Mr. Murphy's Law, no matter how well-designed a piece of equipment is, if anything can go wrong in it, it will. For radio amateurs this holds true for receivers, transmitters, computers, printers, monitors, oscilloscopes, clocks, and so on. Of course, such fires can be quite costly at a minimum, and life-threatening at the worst. What should amateurs do about the possibility of a fire starting in the shack? If a fire does start, what should be done about it?

Plan Ahead

It is most important to plan ahead. A fire extinguisher in every ham shack is probably the first thing that comes to mind. However, a fire inside a screwed-tight metal enclosure is probably not going to be put out by one of the common handheld fire extinguishers, although a carbon-dioxide, or CO_2, gas-type extinguisher might be effective if fed into a vent hole. Of course, if the fire has spread outside of the enclosure, any fire extinguisher will be useful. So, what else?

In many ham shacks, electronic equipment is plugged into one or two portable 120 VAC power-strip boxes plugged into a wall outlet, preferably one which has an on-off switch at one end. The end with the switch on it should be moved to a position where it is easily reached so it can be turned off quickly in an emergency.

When electric sparks or arcs start crackling or hissing, or smoke begins to curl up out of a metallic container or cabinet, a fire or other undesirable action is in progress inside that device. Removing all power to the equipment should be the first thought. In most cases the simple act of turning off the power switch on equipment will stop the trouble. If turning off the power switch does not do it, turn off the power-switch box, or pull its AC line plug out of the wall receptacle. However, if the plug is in back of or under a table or desk somewhere, as it too often is, it may be difficult to get to it rapidly. (If equipment is powered by a battery, the battery cable should be readily available and should be pulled loose.)

If a fire starts and it is not possible to get near the power plug for the equipment on fire but there is a power-line switch box in or near the ham shack that feeds the radio room lines, open that circuit. Be sure you know where the main switch box (or secondary switch boxes) is. Make sure you know the location of the ham shack 120 V and 240 -V circuit-breakers or fuses. Speed in getting to such boxes and circuits may be very important to open the electrical source of a fire in the radio room. Right now could you go directly to the correct switch or fuse box and to the breakers

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or fuses feeding power to the outlets to the ham shack? It might be smart to label them and/or splash some red fingernail polish on them right now.

If the power is removed from any equipment but smoke still pours out of its cabinet, if it has a top- opening door, open it and spray your fire extinguisher down into the area on fire. If the cabinet is screwed together, pull its line cord and remove the hot cabinet to some safe place *outside* using as heat insulation a towel, rags, or even newspapers. If the cover can be opened and active flames are visible, spray them with a CO_2 or dry-powder chemical fire extinguisher, although drowning the equipment in fresh water is another possibility. When the equipment is completely dry, the water may not have damaged any of the still-good parts.

If simply turning off or removing the power line from the equipment stops all arcing, flames, or smoke in a few seconds, which is usually the case, just allow the equipment to cool. It may well be repairable. After a half hour or so of cooling time, maybe aided by a fan, remove the cover and look for blackened parts. If there are few or none, while watching, apply the AC power again and see if the trouble reappears. If there is any arcing or sparking, you now know pretty well where the trouble is located. As soon as the power is disconnected again, you can start looking for the trouble.

When home-brewed equipment that is not enclosed in a cabinet catches fire, after the power is cut off and if flames are still visible, spray the fire area and any nearby items showing smoke or flame damage with a fire extinguisher.

Call 911 First

Whenever you believe there is a fire starting in a piece of equipment, in a house, in any other building, or anywhere, *call 911 immediately* to get firemen and equipment rolling toward the scene. In most cases they will be glad to turn around if you call back and advise that the fire has been brought under control. This should not be considered a false alarm, as you reported a probable fire. Usually one unit will continue in to make sure everything is actually completely cold and to fill out an accurate report of the call.

All electricity to any room that catches on fire should be turned off. When firemen arrive, advise them that all electricity in the area has been turned off. They may be using water, which does not go well with live electrical AC cir-

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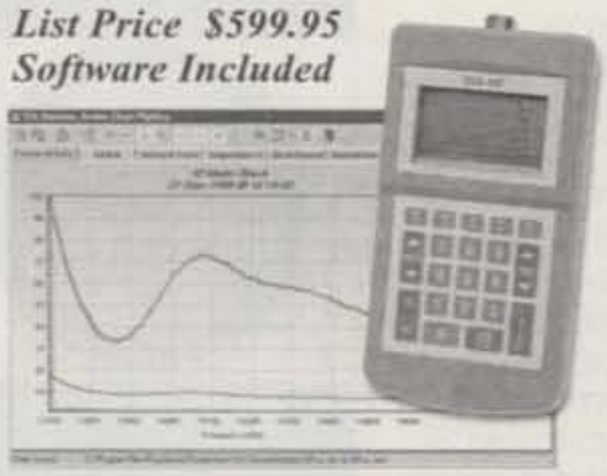
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W6BNB
Teacher , Author, Fire Chief

Bob Shrader, W6BNB, is familiar to many of you as the author of *Electronic Communication*, published by McGraw-Hill (as well as many articles in *CQ*). This is one of the bibles of the radio communications industry. Bob is also a former fire chief and author of *Fire Fighting, How It's Done*, published by Vision Books International. Bob says he came to that position in a rather unusual way and that radio played a key role:

"The local fire department brought one of their transceivers that wouldn't work to where I was building my house. They had heard I was a recently retired junior college radio instructor. I fixed their rig (for free), thereby becoming an instant member of the volunteer FD. After about four years as their Communications Officer, fireman, Captain and Training Officer, I was elected by the board to be their new Chief. Not the usual path for becoming a Fire Chief!"

cuits. Firemen may use large carbon-dioxide or other extinguishers on medium-size fires, particularly around radio or electrical equipment. For larger fires they may also use special foams that consist of carbon-dioxide bubbles, or simpler foams having air bubbles, which cools the fire area and limits oxygen getting to flames. If the fire has extended to other parts of the room, they will use water fogs, sprays, or streams.

Once you've called the fire department, you can try to put out the fire yourself if it's contained to a very small area. The two fire extinguishers recommended for electrical fires—after power has been removed—are the CO_2 and the dry-powder chemical types. The dry chemical coats hot or burning areas with special powders that prevent oxygen from getting to the burning area, which stops flames. However, it really makes a mess of the sprayed fire area. The CO_2 extinguisher covers the burning area with cold, non-combustible carbon-dioxide gas, keeping oxygen away from the hot area, stopping flames. Carbon-dioxide gas comes out of a CO_2 extinguisher as a white, extremely cold fog. By replacing the oxygen in the air with non-combustible CO_2 gas, flames cannot exist, and at the same time the gas rapidly cools both the flaming surface and any heated areas under or around the burning surface layer, helping to prevent re-ignition after the flames have been knocked down. Such CO_2-type hand extinguishers may cost more, but if they save a piece of electronic equipment worth several hundreds or thousands of dollars, they might be well worth their extra cost.

Two things to remember: Flames are only extremely hot gasses, and all heated gasses rise. Therefore, when spraying any kind of fire, start at the bottom and put out the lower flames before raising the extinguisher to put out higher flames. Make sure the lower flames stay extinguished by immediately returning to them if they re-ignite. Small hand extinguishers usually will only extinguish small fires. Larger fires will require large CO_2 commercial extinguishers, a water fog, a water spray, or a water stream to cool them below ignition temperatures. Fires are chemical reactions. Almost any chemical reaction if cooled enough will stop reacting. This is why firefighters keep drowning a burning item—to make sure the inside areas are cold enough to prevent reignition.

If a fire gets larger than you can knock down with a hand extinguisher, a garden hose with a spray nozzle can be tried until the firemen arrive. Again, start low with the water spray and raise it as the lower fire areas are extinguished. Keep your head below any hot smoke and steam, which always rises to the ceiling. You may have to crouch down near the floor to handle the hose. If the hot smoke gets down to you while you are in a crouched position, crawl out fast, close the door, and let the firemen take over when they get there. Fires today usually involve burning plastic materials which produce toxic smoke. This is why firefighters no longer enter buildings on fire without wearing a mask with an attached portable air supply. After calling 911 and removing all electricity to a larger area on fire, close the door to the room, but have someone go outside in front of the property and direct the firemen to the area on fire.

Fire Prevention

One fire safety act that can be performed daily is to completely close off the ham station room whenever it is to be left for any extended period of time, leaving no open windows, doors, or vents in the room. The thinking behind this is: (1) Air is a mixture of gasses, one eighth being oxygen. (2) Any sealed off area allows no new oxygen to get into it. (3) A fire can only continue to burn as

long as it is being fed the oxygen needed to combine chemically with hot fuels to produce more flames and heat. (4) If a fire starts in a completely sealed off room, it may only take a few minutes for all of the oxygen in the air to be used up by the oxygen/fuel chemical reaction that produces the flames.

Flames are gasses whose molecules and atoms are energized to the point where they radiate tiny energy packets called *photons*. Photons developed by flames have frequencies of both light and heat. We can only see the photons generated in the red through violet frequency ranges. Lower infrared frequency photons are invisible, but they are the heat producers. Without oxygen, flames may go out, but the oxygen-depleted air in the room also contains the hot heat-energy infrared photons bouncing around, bringing everything in the room up to a very high temperature. The result is everything in the room becomes scorched and usually stained brown. Most plastic things melt. The important thing is that the flames, and the photons they cause, will wear out without oxygen and flames and will eventually cool, so damage may be confined to that one room only and hopefully never involve any other areas of the building. It will take several hours for such a room to become cool enough to enter.

Similarly, when any rooms in a house are to be left unattended for any extended period of time, it is wise to seal them off. All doors and windows should be shut tight. All ventilation, cooling and heating, should be turned off. The bottom of all doors should have minimal space between them and the floor to allow little or no external air to enter any room in which a fire may start for some unknown reason.

If you ever see wisps of smoke puffing out from under a closed door, or see windows that have turned brown on the inside, do not open any door to that room! Call 911 for the fire department. There is great danger of a "smoke explosion" occurring if fresh oxygen is suddenly allowed to enter a hot, smoky, closed-off room. Smoke is, among other things, hot carbon particles that will combine explosively with oxygen to form carbon dioxide. Such a smoke explosion caused by opening a door to a room that is, or has recently been, on fire can kill you! Another thing: If a metal door knob on a shut door to a room ever feels hot to the touch, do not turn that knob. Call 911 for the fire department immediately! Tell them there is danger of a smoke explosion. Get everyone out of the building. On your way out, to prevent air oxygen from getting into a burning room, throw any readily available blankets, pillows, etc., against the bottom of any doors showing smoke coming out from under them. Move out of and safely away from the building until the firemen have taken care of the emergency.

Fire extinguishers probably should be mounted near the exit doorway of your radio equipment area, but don't forget about them. Over a period of time all extinguishers will lose their internal gas pressure. Check the pressure indicators frequently. There is no feeling worse than pressing the handle or button at the top of a fire extinguisher in an emergency and receiving no usable output from it! Replace any extinguisher if its pressure gauge indicator points below the green area and into the red. If the extinguisher is a rechargeable type, have it recharged at a local fire equipment company. If it is not rechargeable, buy a new one and get rid of that old one!

Radio amateurs are fortunate that most modern electronic equipment purchased today is well constructed and should provide minimal fire danger. This may not be true of some of our home-brew circuits, however. When doing any building of equipment, or changing circuits in a piece of gear, or when rearranging the location of pieces of radio equipment, consider the possibility of heat from one device overheating something above it. Do not cover air vents in equipment; they are there to prevent heat build-up. If infrared photons from warm transformers or hot resistors can heat internal air and the hot air rises, it may eventually overheat something above and start a fire there.

It is quite possible that electronic equipment can catch on fire at any time, even when not turned on. If there are vent holes in cabinets, bugs may crawl inside, make a connection across two hot AC electrical points, and cause an electric arc. This electrocutes the bug of course, but sometimes may start a fire. Many modern pieces of electronic equipment have a timing clock or warming circuits permanently connected to the power line which can possibly arc over due to old age, accumulated dust, high humidity, bugs, or for any other reason. The AC lines into the equipment sometimes can become shorted. Don't forget: As long as old man Murphy is at work, almost anything undesirable can happen. Always think about fire safety with anything you do. ■

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Math's Notes

What's New And How To Use It

BY IRWIN MATH, WA2NDM

Printed-Circuit Fabrication Software Review

While we usually do not devote an entire column to a product review, the following item is so professional (and inexpensive) in the results it produces that I thought it would be a good idea to show readers what is actually out there for your use if you simply look hard enough. Today's software makes it easy to achieve almost the same results that the large engineering firms do.

The software package to which I am referring comes in several parts—WinDraft Schematic, WinBoard PC Board Layout, and Spice Simulation. Available from IVEX Design International (web site <http://www.ivex.com>), the software comes in various "modules" all loaded onto a CD. The first of these, WinDraft, is a schematic entry package. This package allows you to "draw" a professional schematic with your computer and either print it or save it. All standard components (even vacuum tubes) are provided in a number of extensive libraries, and you can even group your most commonly used components in a user-defined "palette" if you wish. Both leaded and surface- mount type components are included in the various libraries, and component symbols can be changed if desired.

The software is very user friendly, and with no prior experience it took me less than an hour of "playing around" to produce the very acceptable schematic of an audio amplifier (fig. 1). You will notice that the printed results are as good as any schematic made with packages easily costing ten times as much. Once the schematic is finished, the software allows you to produces a pretty complete bill of materials at the push of a single button.

Another very nice feature of WinDraft is the ability to view a component's symbol as well as designated mechanical "footprint" before actually adding it to the design, as well as the ability to modify the part any way you like or even create a new part. Finally, an "Electronic Rules Check" feature allows you to assure that all components are properly connected, which is important if you wish to export the design for printed-circuit layout purposes.

c/o CQ magazine

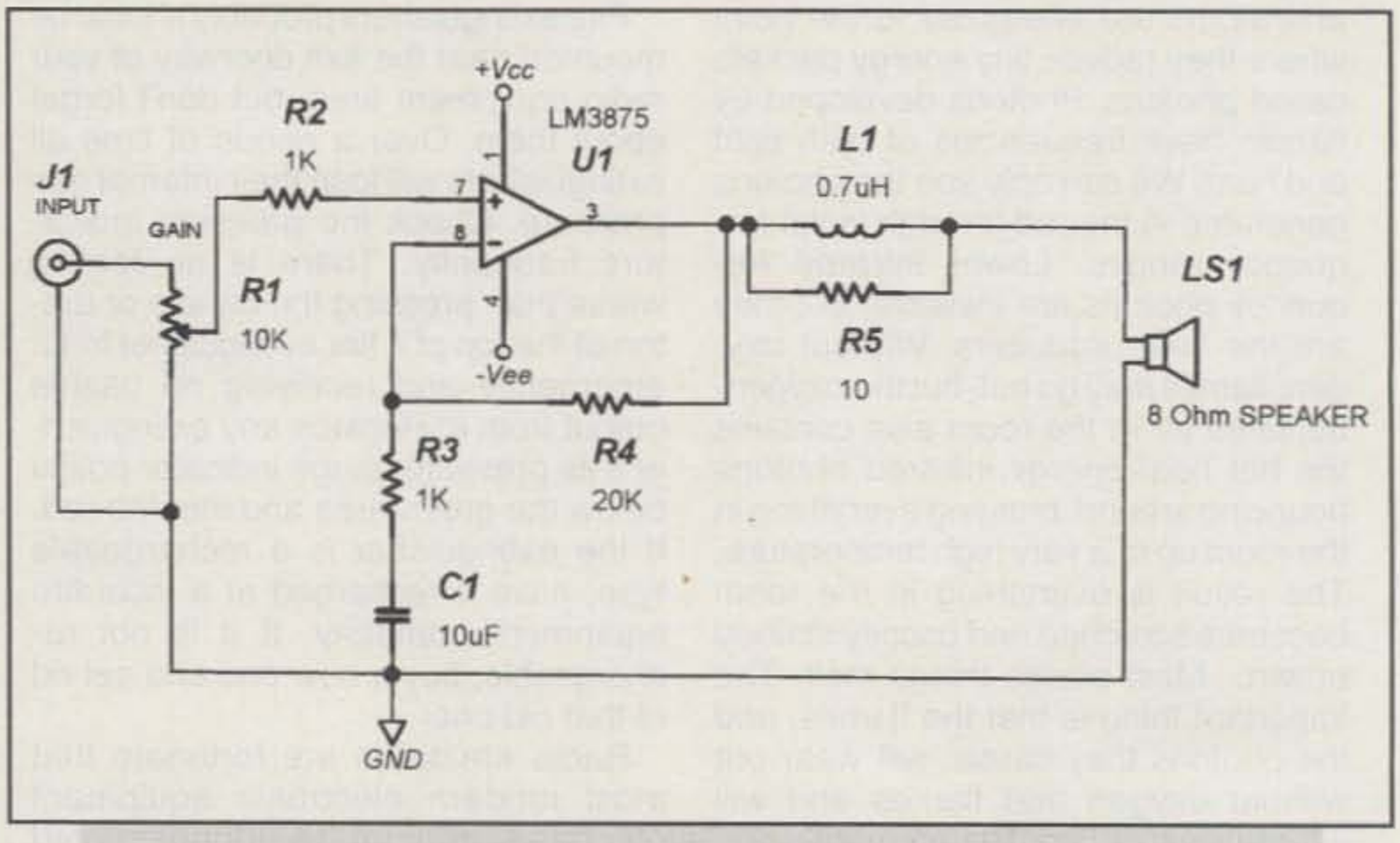

Fig. 1– Audio amplifier drawn using WinDraft.

WinBoard is the companion printed-circuit-board program from IVEX which will import a schematic drawn with WinDraft and allow you to lay out a complete circuit board. This program can generate both single- and multi-layer boards and will handle leaded as well as surface-mount devices. When a schematic is imported, all components are "rubber-banded" together, virtually eliminating the possibility of errors. A complete library of both surface-mount and through-hole-mount components is provided, and the Ivex website contains both new and user-modified libraries you can download. Multi-layer boards as well as simple two-sided versions are accommodated. A copper pour feature allows ground planes, and land and lead traces are modifiable by the user.

A third "module" is called IVEX Spice. This package allows you to actually simulate circuits on the computer without building anything! You easily can see what happens with variations in component values or tolerances, and when you are finished with a design, you have something that is easily 90% there. Then a little bit of final "tweaking" to take care of stray capacitances and layout (if the circuit is in the RF range) will be all that is necessary to complete a design. IVEX Spice uses models developed with Berkely Spice Technology, the same as the more expensive packages.

The cost for the basic version of WinDraft is $39.95. This version allows you to connect (and save) schematics with up to 200 pins. For larger requirements a 350-pin version is available for $125, a 650-pin version for $250, and an unlimited version for $495. Compared to thousands for schematic entry packages with the same capability, this is a bargain.

The cost for the basic version of WinBoard is $29.95. This allows you to fabricate PC boards with up to 200 pins. For larger requirements a 350-pin version is $125, a 650 pin version $250, and an unlimited version $495.

IVEX Spice is only $99. A website special allows you to purchase both programs along with the simulator for a price that saves hundreds of dollars.

I would like to thank IVEX for providing the 200-pin versions of WinDraft and WinBoard for this review. Visit their website for more details.

73, Irwin, WA2NDM

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Reader Survey
February 2001

We'd like to know more about you—about who you are, where you live, what kind(s) of work you do, and of course, what kinds of amateur radio activities you enjoy. Why? To help us serve you better.

Each time we run one of these surveys, we'll ask several questions and ask you to indicate your answers by circling numbers on the adjacent survey card and mailing it back to us. If the card is missing, just write your response numbers and the date of this issue on a postcard and mail it to *CQ* Reader Survey, 25 Newbridge Rd., Hicksville, NY 11801. We'll pick one respondent to each survey for a complimentary one-year *CQ* subscription (or renewal).

This month, we've got some questions about building your own equipment and accessories.

Please indicate... **Circle Survey Card #**

1. There is a common perception that, compared to past times, today's hams tend to be "appliance operators" who don't build equipment. What is your view of this perception?
- Agree 1
- Disagree 2
- No opinion 3

2. Have you ever built a piece of ham radio equipment (circle all that apply)?
- Yes, from a kit 4
- Yes, from magazine plans 5
- Yes, from own design 6
- No 7

3. Have you ever built a piece of electronic equipment as part of your job (circle all that apply)?
- Yes, from a kit (or equivalent) 8
- Yes, from plans 9
- Yes, from own design 10
- No 11

4. Have you ever helped/taught someone else to build a piece of ham gear?
- Yes 12
- No 13

5. Has anyone ever helped/taught you to build a piece of ham gear?
- Yes 14
- No 15

6. Have you ever built something as part of a club or group project?
- Yes 16
- No 17

7. Would you be interested in taking part in a club or group construction project?
- Yes, as a builder 18
- Yes, as an instructor/coach 19
- Maybe 20
- No 21

8. Have you ever participated in a large-scale ham radio construction project, such as a club station, repeater or digital node, or amateur satellite?
- Yes 22
- No 23

9. Would you be interested in participating in a large-scale ham radio construction project, such as a club station, repeater or digital node, or amateur satellite?
- Yes 24
- Maybe 25
- No 26

10. How would you rate yourself as an electronics builder, based on your skills and experience (ham and non-ham)?
- Non-builder 27
- Novice 28
- Experienced 29
- Advanced 30
- Expert 31

Thank you for your responses. We'll have more questions for you in our next reader survey.

What You've Told Us...

Our December survey asked about your recent or planned ham radio purchases. The results should bring a smile to the face of anyone who builds or sells ham gear, and to our advertising department...

Among the readers who responded, 86% said they've made a ham radio purchase in the past 12 months, and 84% said they plan to buy some ham gear within the *next* 12 months. Eighty-four per cent also said they bought or will buy *new* gear, while 23% bought or plan to buy *used* equipment (some people bought both; that's why the total is more than 100%).

Most of you are using traditional means—primarily magazines—for researching and buying your ham equipment. Magazine ads are the main information source for 46% of you, followed by a tie way down at 16% between manufacturers' brochures and friends' recommendations. Manufacturer websites come in with only 13%, followed by on-air recommendations (6%) and dealer recommendations (5%).

Mail-order purchases from a dealer are far and away our readers' favorite way of buying gear, with a clear majority (52%) expressing that preference (numbers here add up to more than 100% because people bought from more than one source). There was a tie between dealers/in-store and other hams/in person at 22% each, followed by dealers/online at 20%; manufacturer direct/mail-order at 18%; dealers at hamfests 10%; online from manufacturers and other hams (including auction sites) at 6% each; manufacturers at hamfests (4%); and other hams by mail (3%).

Finally, more than half of you (54%) spent (or plan to spend) $500 or more on your new ham gear, while more than one third (35%) budgeted more than $1000 for ham purchases, and 44% spent or planned to spend less than $500.

This month's winner of a free 1-year *CQ* subscription is E. Taublieb, KB2KVA, of Buffalo, New York. As always, thank you to all who responded to our survey.

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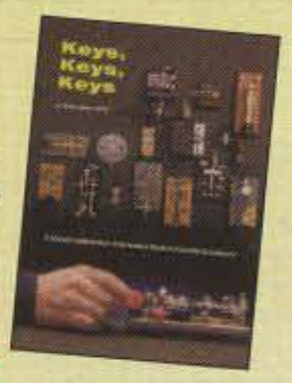

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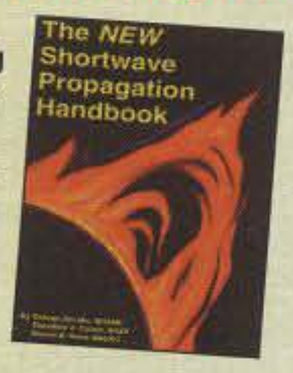

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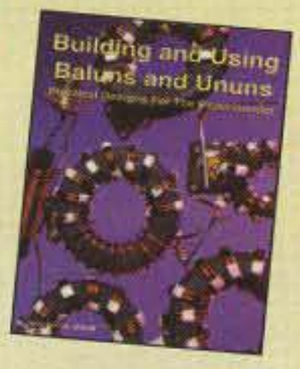

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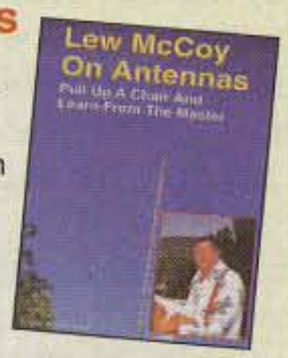

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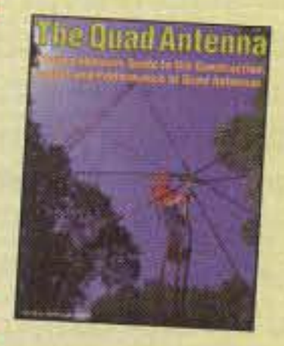

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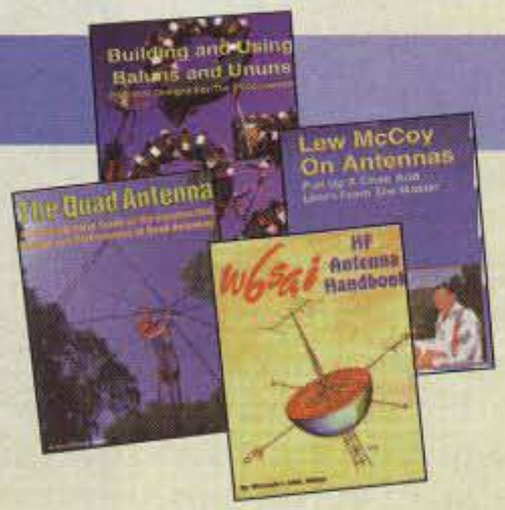

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The ultimate DX, so far, is making contact with another ham by bouncing your signals off the moon. Known as "moonbounce," or EME (Earth-Moon-Earth), this is a challenge for even the most experienced ham.

A Moonbounce Primer

BY KEN NEUBECK,* WB2AMU, AND JOHN BUTROVICH,* W5UWB

EME (Earth-Moon-Earth) is a VHF activity that requires a little bit of work to get started, but it can lead to exciting challenges. The work involves (1) getting the necessary equipment, such as multiple Yagi arrays, rotators, and pre-amps; (2) learning how to track the moon in azimuth and elevation from moonrise to moonset; and (3) a great deal of operating skill. It is a segment of the hobby that requires a lot of dedication and determination, but you don't need everything in order to get started. The reward is that you can work up to half the world (anywhere the moon is shining when it's also shining on you) on VHF and UHF.

Let's see how you start out on EME by recounting the efforts of John, W5UWB, who got started with moonbounce in 1980. By 1980 John had worked approximately 36 states on 2 meters from his QTH in south Texas (grid square EL17) by various means of propagation such as tropo,sporadic-*E,* meteor scatter, and one rare aurora opening. By that time it became obvious to John that additional states, most of which were over 1400 miles away, were going to be very hard to come by. He then decided to try some EME by using a single Yagi antenna, a Cushcraft Junior Boomer (17 feet boom length). He mounted a .3 dB pre-amp at the antenna with the necessary relays to bypass it on transmit. He then set up schedules with other EME operators by getting on the Two Meter EME Net that meets on 14.345 MHz at 1700 UTC on Saturdays and Sundays.

John had immediate results by working two New England stations: Lance WA1JXN, who had a 12 Yagi Cushcraft array, and Dave, K1WHS, who had a 24 Yagi setup. Schedules took place on moonrise when the moon was at zero to 12 degrees elevation to his location. In short order with his single Yagi setup John was able to work 46 states. However, he realized that he would need a larger antenna system in order to achieve WAS (Worked All States). He then put up four 16-element KLM Yagis. With this setup and schedules arranged on 20 meters, he was finally able to complete Two Meter WAS in 1988.

One of John's most memorable single Yagi contacts was with K6MYC/KH6, who took four 16-element KLM antennas to Hawaii in February 1984. John believes that this is the first single-Yagi to four-Yagi QSO. Total initial QSOs made by John using the single Junior Boomer antenna was 17 with total

The antenna system at W5UWB. On the high tower John has (from the top) 11 elements on 222 MHz over a 17-element M² Yagi for 2 meters over a 6-element W1JR-designed 6 meter beam. The shorter tower has a 35-element M² Yagi for 1296 over a 25-element K1FO design for 432. (W5UWB photo)

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QSOs at 28. (An initial QSO is your first EME contact with a particular station.)

Two Meter Setup And Requirements

In view of the estimated path loss of about 253 dB, it is generally accepted that to be successful each station should have 20 dBi antenna gain and 1000 watts—i.e., four 2.2-wavelength Yagis. However, greater antenna gain at one station will decrease the requirement for the other station. For example, Dave Blaschke, W5UN's large array of 48 five-wavelength Yagis has allowed Dave to work European stations that are only running 100 watts with a single Yagi and utilizing ground gain on their moonset (ground gain provides a boost of up to 6 dB).

Currently there are many stations with large arrays (16 Yagis or more) that would allow you to make contacts with these stations off the moon using lower power and only one Yagi. Some smaller stations using four Yagis are using cross-polarized antennas and are capable of working a single Yagi station running 1000 watts or so. The crossed Yagis allow them to select either horizontal or vertical polarization, thus helping to reduce Faraday rotation "lockout," which we will explain later.

Single Yagi operation on 2 meters takes a lot of persistence and the ability to listen to a lot of "white noise"! You need to ensure that feedline losses are kept to a minimum, preferably less than .5 dB. Feedline lengths of less than 75 feet are recommended and, as a minimum, LMR-600 style line or equivalent. Hardline of 7/8 inch or larger would be of great benefit. A mast-mounted pre-amp is preferred (with noise figure less than one dB) in order to set the overall system noise figure, but it is not an absolute requirement. At the receiver, use of the narrow CW filter or DSP and an outboard audio filter can be an asset. The best filter, of course, is your ears. With practice you can read a signal that is at or even a bit below the noise level.

The physical layout of the surrounding terrain is of importance because of the additional "ground gain" that is available at certain elevation angles. A person who lives in the country surrounded by flat terrain will obtain greater ground gain than a person in town surrounded by houses and trees.

In John's case, he has a 5-wavelength long Yagi at 53 feet above ground level, with flat country farmland for miles in all directions. The calculat-

Vernice Butrovitch, John's wife, getting ready to inspect his 6 meter, 2 meter, and 222 MHz antennas. Vernice, who is a piping designer and draftsperson and whose work requires extensive climbing, has installed all of W5UWB's antennas, towers, rotators, and guys. John had heart surgery in 1996 and is no longer able to do antenna work. (W5UWB photo)

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ed gains (three lobes in his case) are as follows. (Note: the free-space gain of a 2 meter 5-wavelength Yagi is about 14.8 dBd or 16.9 dBi.):

First lobe: 1.00 degrees to 2.75 degrees gain is between 19.8 and 22.4 dBi

Second lobe: 5.0 degrees to 6.3 degrees gain is between 20.5 and 21.8 dBi

Third lobe: 9.0 degrees to 10 degrees gain is between 20.3 and 21 dBi

Utilizing ground gain reduces the requirement for a super-large antenna at the other station. Presently, under ideal conditions John is able to make contacts with four-Yagi stations that are running 1 KW and up. Local noise, path degradation, and things such as Faraday rotation (we haven't gotten to that yet) all enter into the picture to determine whether or not a contact will be made.

432 MHz Setup And Requirements

Path loss on 432 MHz is considered to be about 9 dB greater than on 2 meters because of the "antenna" effect. A dipole for this band is one third the size of one for 2 meters and thus will only capture one-ninth the power as the 2 meter dipole. Therefore, you must have a larger array to get the equivalent "capture area." Minimum gain requirements are about 24dBi on this band, and four 6-wavelength Yagis would seem to be the minimum requirement. It is very important here to have a low-noise preamplifier (.5 dB) mounted at the antenna array with suitable switching for transmit and a low-loss feedline (preferably hardline coax). Expect Faraday rotation to be much slower on this band with longer "lockout" periods due to crossed polarization.

The Best Times for EME

Since EME signals by and large will be very weak (except for the Big Guns who can actually move your S-meter!), all steps should be taken to reduce noise, both external and system-generated. Nighttime may be somewhat better because of reduced manmade noise. Conversely, nighttime dew on power lines can mean an increase in noise!

Many popular computer programs (Sky Moon by W5UN, for example) will provide azimuth and elevation of the moon and plot the path degradation, taking into account the distance the moon is from the Earth and the background noise from our own galaxy and distant star systems. This program will also indicate the Doppler frequency shift to be expected (2 meters: up to +400 Hz on the rising moon, –400 Hz

The Single-Yagi EME Guy

We asked Chip Margelli, K7JA, an active EME guy, to describe the significance of single Yagi-type stations making EME contacts:

Here's the best way I could describe single-Yagi EME. If you have a relatively long Yagi—i.e., one which is 17 to 36 feet long (or more!)—you should have no difficulty in working a half dozen of the big boys if conditions are "favorable" and with a little patience to allow Faraday rotation to come around *(see main text)*. Some nights it just doesn't happen, and other nights you can work W5UN with one call. This is with a typical 150 watt "brick" amplifier. If you have more power it will be easier (500 watts or more makes it a cake walk).

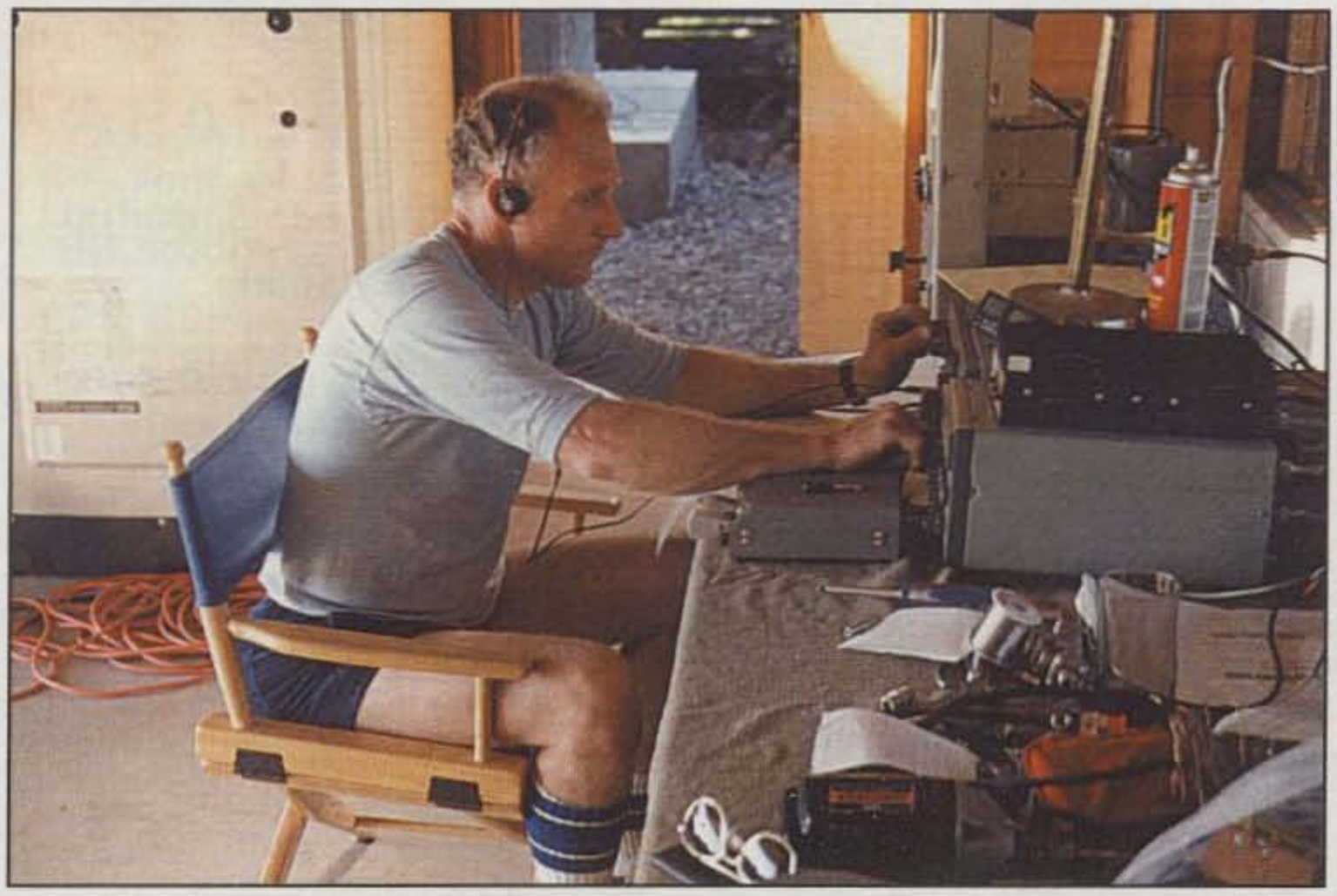
If you have more power (i.e., 1000 watts out), you should be able to have the same results with anything from about 4 elements up. As long as your location is relatively quiet, you can hear at least a dozen stations with a little 4-element Yagi such as the Cushcraft 124WB (no fooling). I worked K5GW random (answering his CQ) running about 900 watts out with a 124WB taped to a stick and shoved into my Black & Decker Workmate, and shooting through the 12 KV power lines that run along my back wall.

I have worked W5UN with as little as a single 10-element Yagi (17 ft. boom, K5GW design) and an FT-847 "naked" (no external preamp, no PA, and not-so-great coax such that I had 38 watts at the antenna). I still want to try UN with the 124WB and the naked 847.

Now, you *do* run out of stations fast with one single Yagi. Once you get past W5UN, K5GW, KB8RQ, SM5FRH, I2FAK, SM7BAE, and others like them, it gets really tough. Especially if you are operating from a quiet location, it gets frustrating, as you can hear a lot of stations, but they just can't pull you through. But with 150 watts and one long Yagi, there is a fair amount of DX that can be worked, especially if you make some provision for rotating the boom so as to change polarization.

For a DXpedition, Mike Staal at M-Squared has made up a really long (8 WL) Yagi that can work a *lot* of stations. It is a little tough to elevate the antenna on an expedition, so you work quickly around moonset and moonrise. Maybe you could tilt the back end down a bit via "Armstrong" rotation, if the mast is high enough. But the 8 WL beam and 500–1000 W would work a ton of stations.

In the meantime, one or two smaller Yagis, with 150 watts out the door, will teach you a lot about Faraday, good scheduling times, and how to listen (I use the narrowest DSP bandwidth I can get—usually 25 Hz.). A single Yagi will fry the hell out of RS-13!! (Please don't blast your friendly local satellite.)



Mike Staal, K6MYC, operating his portable moonbounce station from Hawaii. (K6MYC photo)

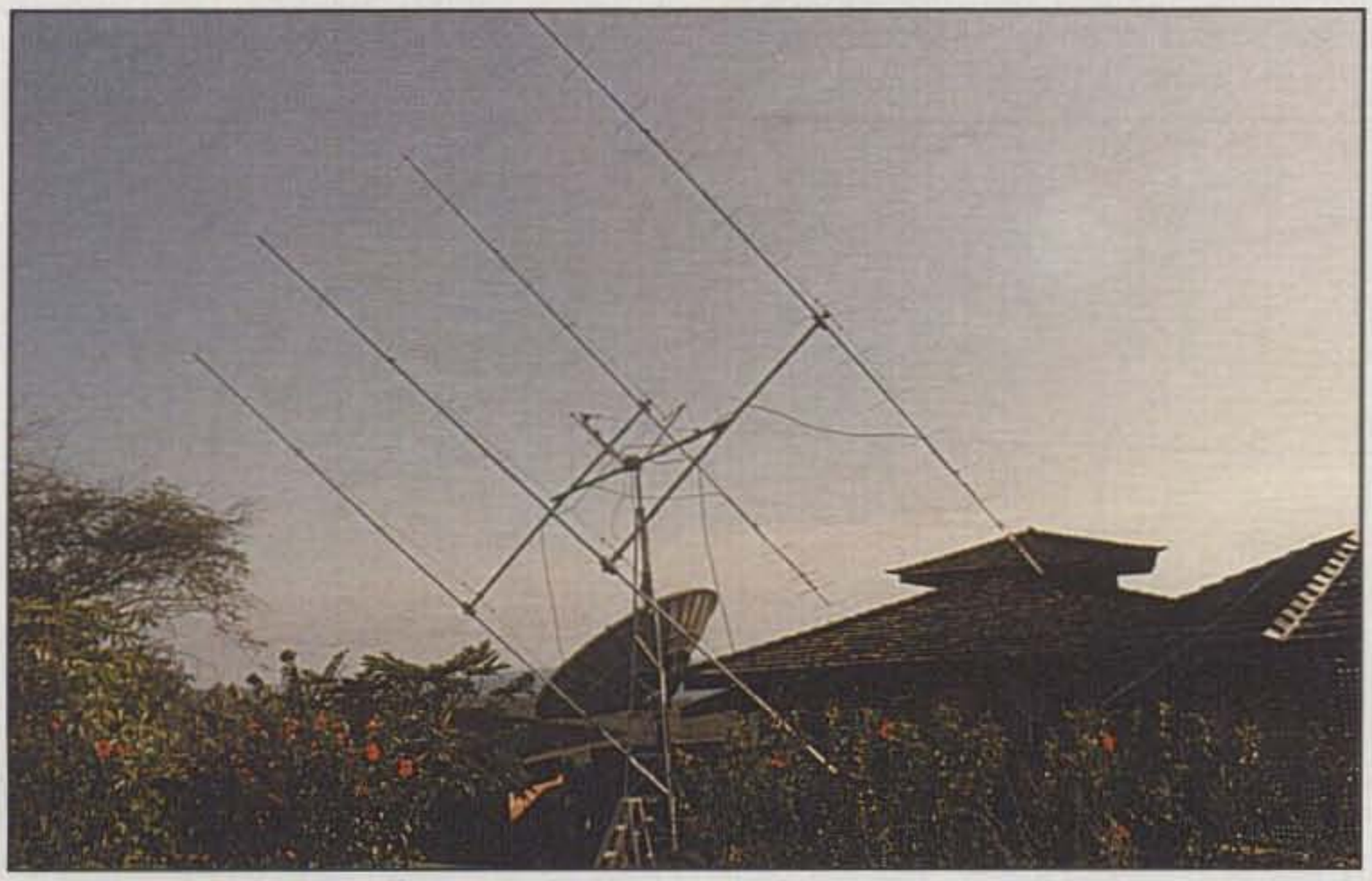
on the setting). The best times of the month are when a full moon, nighttime, lunar perigee (moon closest to the Earth) and a high northerly declination all coincide. John also points out that the days before and the day after a New Moon are usually bad for EME because of sun noise.

There are a number of websites on the internet that have these best times for EME. One of them is <http://www.qsl.net/ea6vq/w5luu.html> .

Polarization Problems

On 432 MHz and below, most stations use linear polarization for EME work. Yagi stations use the same horizontal polarization that is used for terrestrial VHF weak-signal work. The problem with VHF EME work is that the transmitted polarization is usually rotated before it reaches the receiving station, so there generally will be large losses in signal strength. As EME signals are always close to the noise level and often have rapid fading, even a 1 dB loss is noticeable. There are two types of rotations that are of concern in EME work, Faraday and geometric rotation.

Faraday Rotation. As a radio wave passes through the ionosphere, it will



K6MYC/KH6's four-Yagi EME array at Mike's Hawaiian QTH. (K6MYC photo)

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EME From Hawaii

We got some very valuable input for this article from Mike Staal, K6MYC, a big-time EME operator who has made some very important moonbounce contacts over the years. Two historic contacts were made during a single trip to Hawaii in 1984.

On February 18, 1984 Mike and Kobie Furstenburg, ZS6ALE, broke the world 2 meter EME record when they made contact over a distance of more than 20,000 kilometers (12,400 miles). The contact took about six minutes to complete. Mike recalls that the signals were good and his echoes were great. After the contact Mike sent SSB echoes for about 5 minutes with 100% copy on the returns until the moon set over the Pacific. Mike noted that the extra 6 dB ground/ocean gain was sure great to get both going and coming back!

Mike was running an 8877 amplifier at 1500 watts into four KLM 2M16LBX Yagi antennas. During the same trip Mike also contacted John, W5UWB, for the first-ever four-Yagi to one-Yagi EME contact.

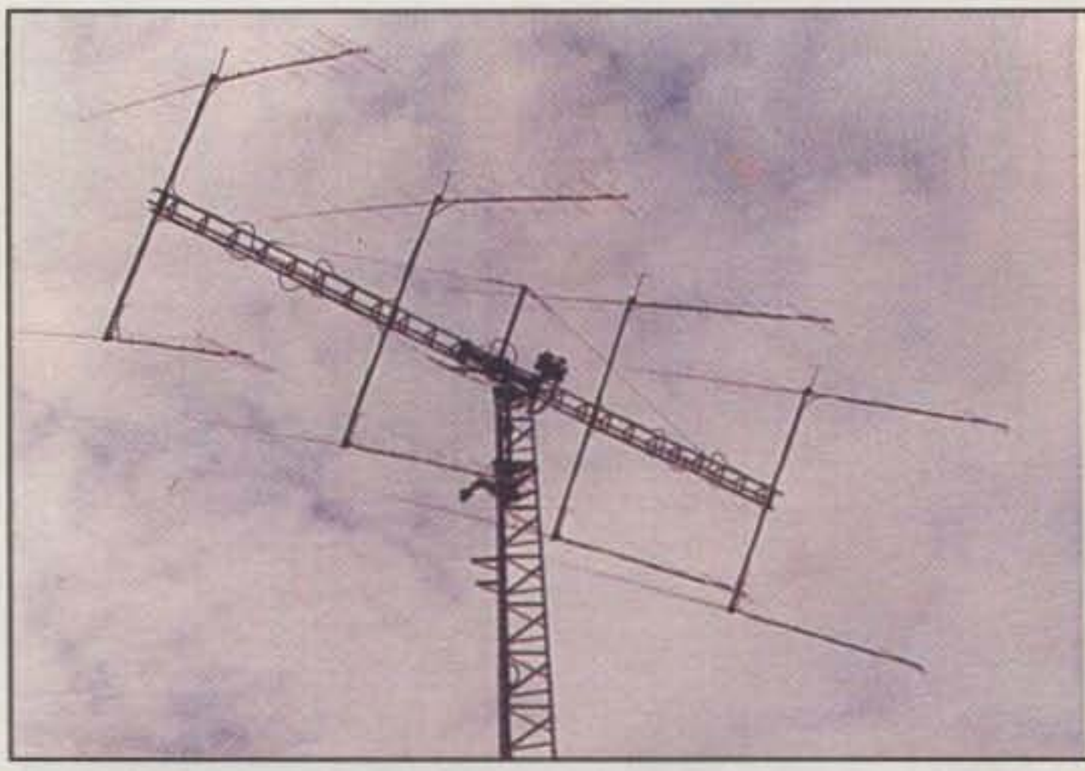

Photo QSL card used by Pat, VE1ASA, showing his sophisticated 2 meter EME antenna array. That's a tower section that he uses horizontally to support the eight antennas.

be rotated in polarity by an amount depending upon the ionization level it passes through. It will be further rotated on the path back. This rotation constantly changes, at a speed depending upon the frequency used. Typically, this rotation is faster at 50 MHz and slower as you progress up in frequency. At 2 meters the period is usually about 20 minutes to complete a full rotation. However, it can be longer depending on the various ionization levels the signal encounters in its round trip, and sometimes you can be "locked out" for a much longer time period. Keep in mind there is about a 20 dB loss from cross polarization (different polarization at different ends of the path).

Geometric Rotation. If the transmitting and receiving stations are on two different continents, there will almost always be polarization rotation between them because of their relative positions on the Earth. This is known as *geometric rotation* (or spatial polarization). Geometric rotation also depends on the moon's position as it varies with time on each moon pass. Further information on Faraday and geometric rotation can be found on G3SEK's EME web page on the internet: <http://www.ifwtech.demon.co.ul/g3sek/eme/pol4.htm>.

One way to deal with these rotation problems is to build an array that can be switched between horizontal and vertical polarization. A good example is the cross-polarized beams built by M^2 Antennas. In fact, M^2 owner Mike Staal, K6MYC, worked 99 stations during the 1999 EME contest with his four-Yagi, cross-polarized array. Stations having the capability to switch polarity at times will find that they must transmit on one polarity and receive on another.

There are a few stations that can rotate their entire array in order to select the best polarization for transmit and receive. This can be a problem with long Yagis. VE7BHQ is using an array of modified Cushcraft collinears, which allows him to rotate the array between vertical and horizontal. (The collinear is very compact front to back, and thus can be rear mounted and then rolled in polarity.)

If you do not have the capability of changing polarization, the problem can be dealt with by waiting for Faraday to roll around (about 20 minutes at 2 meters), along with the spatial difference changing as the moon moves across the sky. Sooner or later everything will line up and allow signals to get through.

John, W5UWB, who uses a single

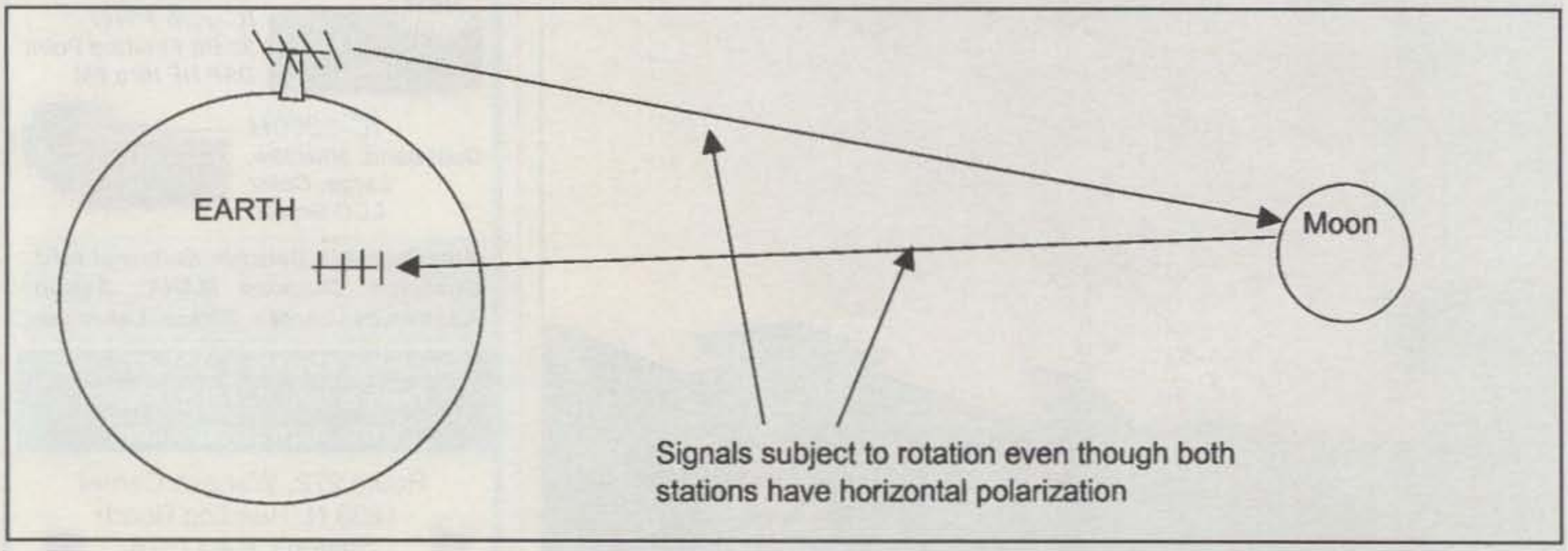

Fig. 1– The basics of an EME contact. Note that a variety of factors may influence signal polarization, even if both stations are using similarly polarized antennas.

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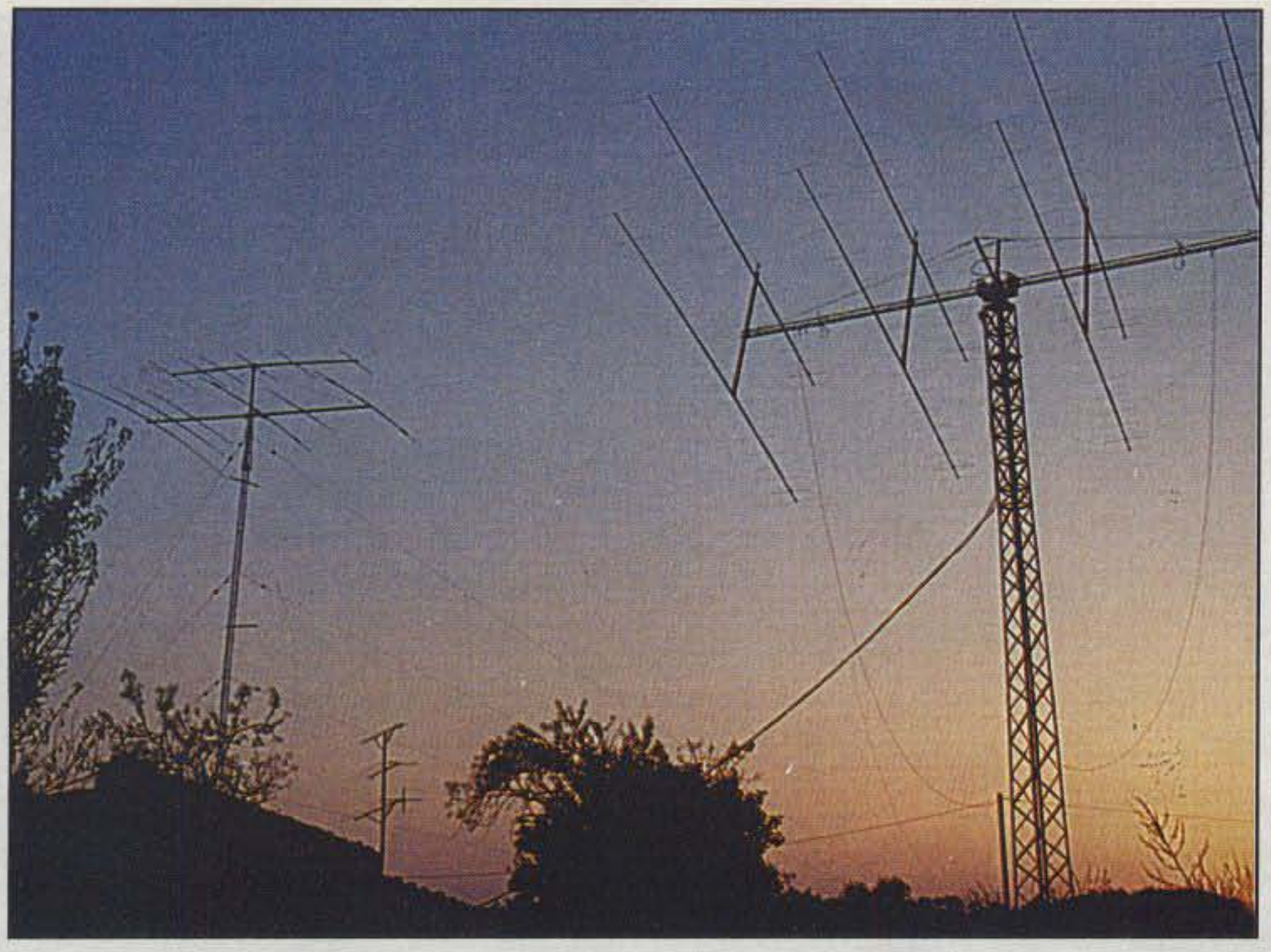

If you get onto EME and manage to work EA6VQ in Spain, here's a look at the antenna system that will be pulling in your signals off the moon. (photo courtesy EA6VQ)

Yagi, cannot be concerned with spatial or Faraday problems. He only has about 45 minutes from moonrise to the last usable lobe (about 10 degrees), so he has to keep his fingers crossed!!

Bands Used for EME

Two meters seems to be the most popular band right now for EME, followed by 432 and 1296. There are some efforts by energetic individuals to work moonbounce on 50 MHz, with good results. On 50 MHz you need at least a long Yagi (boom length 45 to 70 feet!) and high power, along with the real estate to support this setup!

Operating Procedures

Most EME contacts are made using Morse code, although some of the very strong stations have succeeded with SSB contacts. On 2 meters the convention is to use two-minute sequencing with the easternmost station taking the 00 to 02 time frame (00 to 02, 04 to 06, 08 to 10, etc.). This means that the easternmost station transmits for the entire two-minute period and then listens for two minutes. Common practice (on a scheduled QSO) is for each station to call for as many periods as are needed to be heard; the first station that hears the other then sends both callsigns and a signal report. On 2 meters a "0" (zero) is usually the only report sent. If signals are very strong, then a typical RST report may be sent. Assuming the report is received, the other station sends "R" and a return signal report. This continues until both stations have exchanged reports. The second station then sends "R"s and the QSO is complete.

On 432 MHz sequencing is based on 2 1/2 minute sequences. On this band the westernmost station takes the first time period. With random QSOs, especially those involving larger stations that are providing a more easily readable signal, one-minute sequencing is commonplace. On 2 meters one-hour schedules are commonplace (you give up if you haven't completed the QSO in an hour) and on 432 MHz half-hour schedules are utilized.

Conclusion

If you're looking for a new ham radio challenge, this just may be it. As we've shown here, a really big station with really big antennas is preferable, but there are enough of those stations already out there such that they are able to work the "little guys." Thus it's possible to get started (repeat—*started*) with only a single Yagi, 100 watts, and a clear view to the horizon in as many directions as possible. You'll find the experienced EMEers ready and willing to help newcomers join their ranks. ■

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Welcome to Kvarnberget! At the front of the photo is our 20 meter quad; a tower with a 13–30 MHz LPA (log periodic array) and 5-element, 20 meter Yagi; and a tower with the 40 meter quad. On the left is the 15 meter quad, and in the background is the shack and other antennas. (All photos by the author)

Hams living with antenna restrictions and other limits on personal stations might learn a lesson or two from the successful efforts of a group of amateurs in Sweden.

The Nine Towers of Kvarnberget

BY HENRYK KOTOWSKI,* SMØJHF

This is not a fantasy story by J.R.R.Tolkien. It's a true report of how some people solved the problem of high-level amateur radio activity without sacrifying urban conveniences, family life, and financial committments.

There is a place just outside of Stockholm, Sweden called Kvarnberget. It is a patch of solid rock, on top of a hill, surrounded by a sea of pine and birch—and nine radio towers. A small corrugated, iron-clad shack is where numerous cables meet. The cables—ranging from 1 inch coaxial hardlines to twinleads controlling low-voltage relays, some creeping like snakes, some suspended a few feet in the air— reach out for the nine towers.

**Sibeliusg 28 XI, SE-16477 Kista, Sweden*
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The towers are of various heights and sizes, each having a different purpose. One, almost attached to the shack, is equipped with a set of microwave antennas and a platform where one can stand and aim the antennas, place the equipment, take measurements, and conduct tests. Some 12 feet east of the shack, a 60 foot tower carries a 28 MHz, 8-element cubical quad antenna. Going north from the shack, a meager 40 foot mast boasts stacked 144 MHz and 432 MHz arrays.

Further on, a 66 foot tower supports a 21 MHz, 7-element cubical quad. Next is a structure of equal height carrying a log periodic array for 13–30 MHz and a fixed 14 MHz, 5-element Yagi. The northernmost tower is a 72 footer bearing a heavy load of a 14 MHz, 6-element, full-size cubical quad.

Back to the shack and a few feet to the south there is a slender 40 footer with two Yagis sharing a rotator, one for 50 MHz and the other for 21 MHz. West of the shack, a temporary 3-band 3-element Yagi rests on a 26 foot support that is intended for a VHF monster. The leader of the gang, overlooking this gathering, is a 100 footer with a full-size 7 MHz, 2-element cubical quad. There is a platform on top, and microwave beacons for 2.3 GHz and 5.7 GHz dwell there. A set of switched sloping dipoles is attached to this tower.

Who stands behind these towers, these antennas ? Just a bunch of enthusiastic amateur radio operators. They call themselves the Kvarnberget Radio Club, and they identify themselves on the air with the callsign SKØUX.

The club was founded in 1993, but the electromagnetic history of this place goes back to the early '60s, when a microwave propagation research station was established there. Twenty-five

Winter view of the SKØUX shack. In the foreground are parts of a large dish to be mounted on a gun turret. Antennas, from left, are the 15 meter quad, 2 meter and 70 cm stacks, microwave antennas and operating platform, 10 meter quad, 6 and 15 meter Yagis, and 3-element tribander.

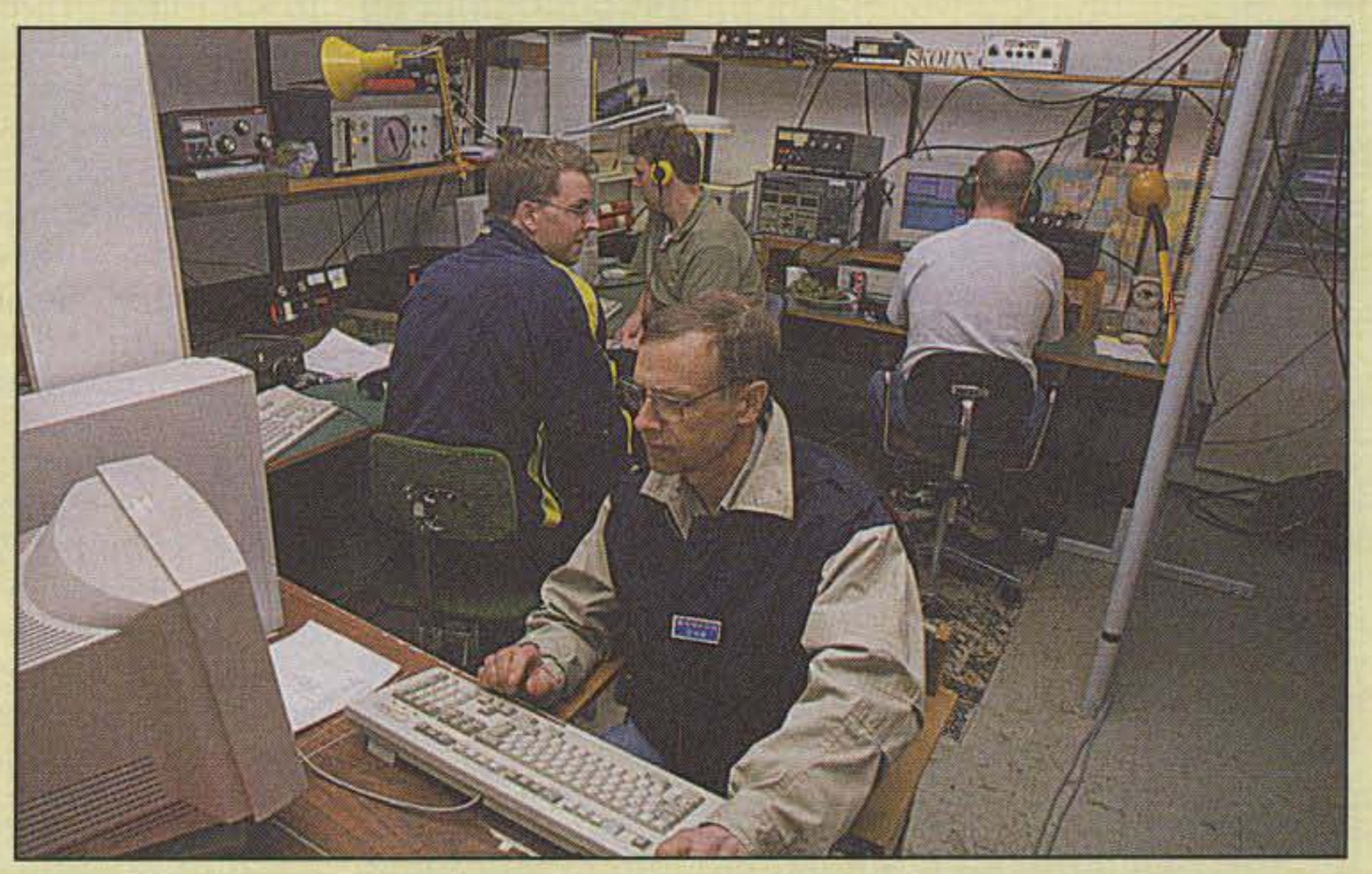
years later, a few local hams spotted this place and soon gained access to the then-closed research station. The local radio club, Täby SändareAmatörer (TSA), already had a well-equipped club station signing SKØMT, but the club was fortunate to have members with visionary insight who predicted their need for a place such as this in the future. Yet, as in many other instances, visionaries are ahead of their time, and most of the local club members were not really interested in this remote patch of granite. Still, some activities took place here, including successful moonbounce, HF, and VHF contesting.

We who appreciated the extraordinary possibilities of this place felt kind of orphaned. The local club was unable to develop the site, so we founded a club of our own. Things started to happen, and in a few years we increased the number of towers, antennas, and, most important, the number of people who come here. The number of club members is almost 40, and the number of visitors has suddenly increased.

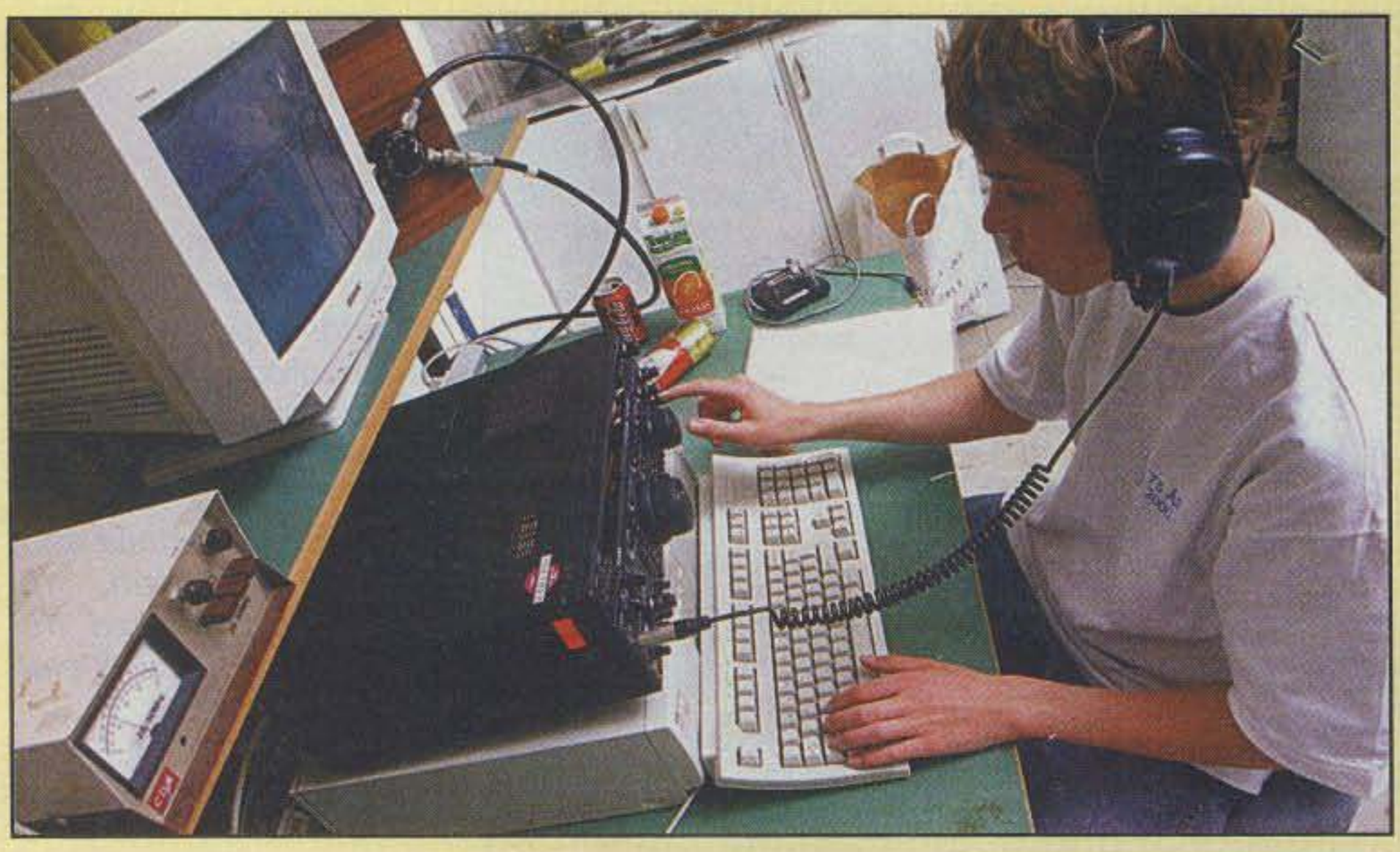
A Solution for Urban Hamming?

My vision is to create a place where anyone with a serious approach to amateur radio can give full expression to the hobby. Large towns are known for a large number of licensees and very low activity on the air. The factors determining this will not diminish; on the contrary, it is going to be more and more difficult to be an active ham in towns and cities. Our rights to install antennas and radiate electromagnetic fields will be restricted—no doubt about it.

The solution to this problem is exemplified by SKØUX. Let's work together, build things that no one is capable of or allowed to build at home, then share them. Just like golf players don't have to own a course, a ham does not have to actually own the antennas, towers, and house. As a matter of fact, the most proficient contesters have rather modest stations, and they often travel to well-equipped or exotic stations. Another thing is that our intense interest in the hobby is sporadic; some years we are more passive, while at other times we are deeply engaged in amateur radio.



HF contest operation at SKØUX. In front is Dag, SMØKDG, an airline pilot and former chairman of the local TSA club (see text), who put a lot of work into the early days of SKØUX. Behind Dag are Johan, SM3UZS, and Magnus, SM3VAC, both of whom traveled hundreds of miles to join the team. In the background is Hans, SMØMXO, who is actually a microwave fan but here works HF contests.



Sixteen-year-old Fabian, DJ1YFK, came over last summer from Germany just to join our multi-op group.

More than just operating ... a bunch of young hams and their girlfriends from this area of Stockholm enjoy a barbeque at Kvarnberget. They are not club members, but all hams are welcome here.

One does not have to dismantle a big antenna farm just because ham radio is at ebb and other things are important at the given moment. Within a group there is always a diversity of talents and a wide network of useful contacts. Some people are good at welding, others can simulate a multi-element antenna array, some people can find surplus towers and cables for free, while still others will guide you in computers. A radio club is both a place to help and be helped, to teach and learn, to give but also to gain. Everyone is a winner, and those who remain outside the group are losing.

Are there any disadvantages to this solution? One major drawback is the fact that there will always be people who will try to take advantage of the work of others. It is a problem here, maybe because the Swedish social model is based on paying high taxes and being taken care of by the state. Many members expect that "someone" will do all this hard work in the club, generally meaning *someone else,* of course. We have some members who won't help when we are building, never have time to give a hand, but demand all rights to use what others have built and even try to control it.

One could say that a radio club is nothing new and that there are thousands of radio clubs all over the world. However, the concept of a club station that is acutally open for hundreds of people who may not be members is probably unique. We receive some financial support from three local clubs, and their members may use our facilities whenever they wish. There is not much equipment at SKØUX, but today's transceivers and amplifiers are compact and easy to bring along. Members have keys and can access the premises any time, providing snow and ice are not cutting off access to the hilltop in ordinary vehicles. Visitors and members of supporting clubs (SK0ØMT, SKØAR, SKØCT) are welcome any time, but arrangements must be made in advance.

Our membership fee is just $30 a year, with youngsters paying less than $10. Supporting clubs contribute $500 each. A total of $3000 per year covers the cost of lease, electricity, insurance, licence fees, and SSA membership. (SSA is the Swedish national ham organization, equivalent to the ARRL in the U.S. or the RSGB in Great Britain.) We lease the land, but we plan to buy it. There is a fund for this purpose, and already something close to $10,000 has been raised. Buying the land we use is not easy, since it is only a tiny part of a large estate owned by the city of Stockholm; our lot has to be parceled out. Once it is done, amateur radio around Stockholm will have a long-lasting bastion, a garrison of Kvarnberget.

If you are visiting Stockholm, come over and visit us. You can even support our project from a distance. Of course, too, listen for SKØUX on the air! ■

How to contact Kvarnberget:
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QRP

BY DAVE INGRAM, K4TWJ

The Art of Low-Power Hamming

Homebrew Your Way to Happiness

Homebrewing, kit building, and dinking with special projects have always been big-time interests in the world of QRP, and with good reason. Contacting friends and working contests with a rig assembled with your own hands is fun, affordable, and a unique experience of the best kind. Where but in QRP, for example, could you get on the air with all new equipment for under $150? Where but in QRP could you build a transceiver small enough to go everywhere and operate hour after hour on a 12 volt lantern battery or a little one amp power supply? Truly, QRP is a major enjoyment mode for the new millennium! Bear those good thoughts in mind, as this month's column features something special in each of the three previously mentioned categories.

First in the spotlight is a new 15 meter CW transceiver kit, the OHR100A/15, from one of the older and most well-known companies in QRP, Oak Hills Research (photo 1). As you may recall, Oak Hills Research was originally started by Doug DeMaw, W1FB, of *CQ*, ARRL, and QRP fame. The company was purchased by Marshall Emm, N1FN, of Morse Express a couple of years ago, and he has done an admirable job of continuing the line (which also includes a five-band CW transceiver, digital frequency counter, and QRP wattmeter). With sunspots peaking and 15 meters red hot for DXing (plus exhibiting minuscule QRM), I would say the new version OHR100A is right on track for the time. Make sense? Let's take a closer look at the OHR100A kit and let you judge for yourself.

The OHR100A Kit(s)

Some of you are probably thinking the OHR100A sounds like a familiar model and asking if it is really "new." Well, yes and no. The original OHR100A kit transceivers were (and still are) available for 20, 30, and/or 40 meters. The new version is similar in design and appearance, but it covers approximately 70 kHz in an owner-defined CW segment of 15 meters, and RF output is 4.0 to 4.5 watts rather than 5 watts as with other band 100A's.

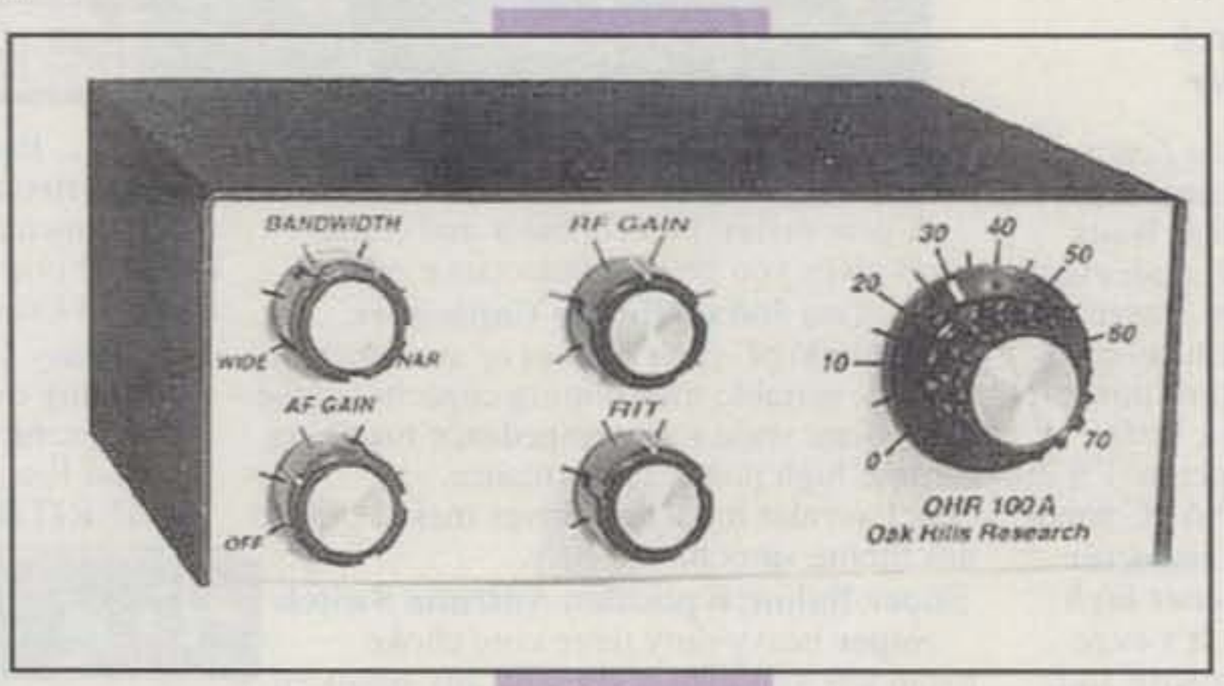

Photo 1– The new 15 meter version Oak Hills Research OHR100A. Transceiver sports four-pole crystal filter, continuously adjustable IF bandwidth, RIT, and a hearty 5 watt transmitter. (OHR100A photos courtesy N1FN)

If you are not familiar with the OHR100A, its condensed block diagram is shown in fig. 1 and a brief discussion follows. The receiver utilizes a superhet design with a popular SA602 mixing incoming and VFO signals to produce a 9.0 MHz IF. A four-pole crystal filter provides single-signal reception, then an MC1350 produces IF amplification and a second SA602 serves as a product detector or BFO. Resultant audio is then routed to an 8-pin LM380 for earphone use or a larger 2-watt-type LM380 for speaker use. A third SA602 is used as a heterodyne mixer in the transmitter section. Its output is buffered and boosted to 5 watts output by a 2N5179, 2N3866, and 2SC2078. The OHR100A's VFO is tuned by a potentiometer controlling voltage applied to a varicap in a JFET circuit. The VFO's 5.00 to 5.075 MHz signal is heterodyned up to 23 MHz for 20 meter operation, 19.1 MHz for 30 meter operation, or 16.0 MHz for 40 meter operation by a fourth SA602. (The

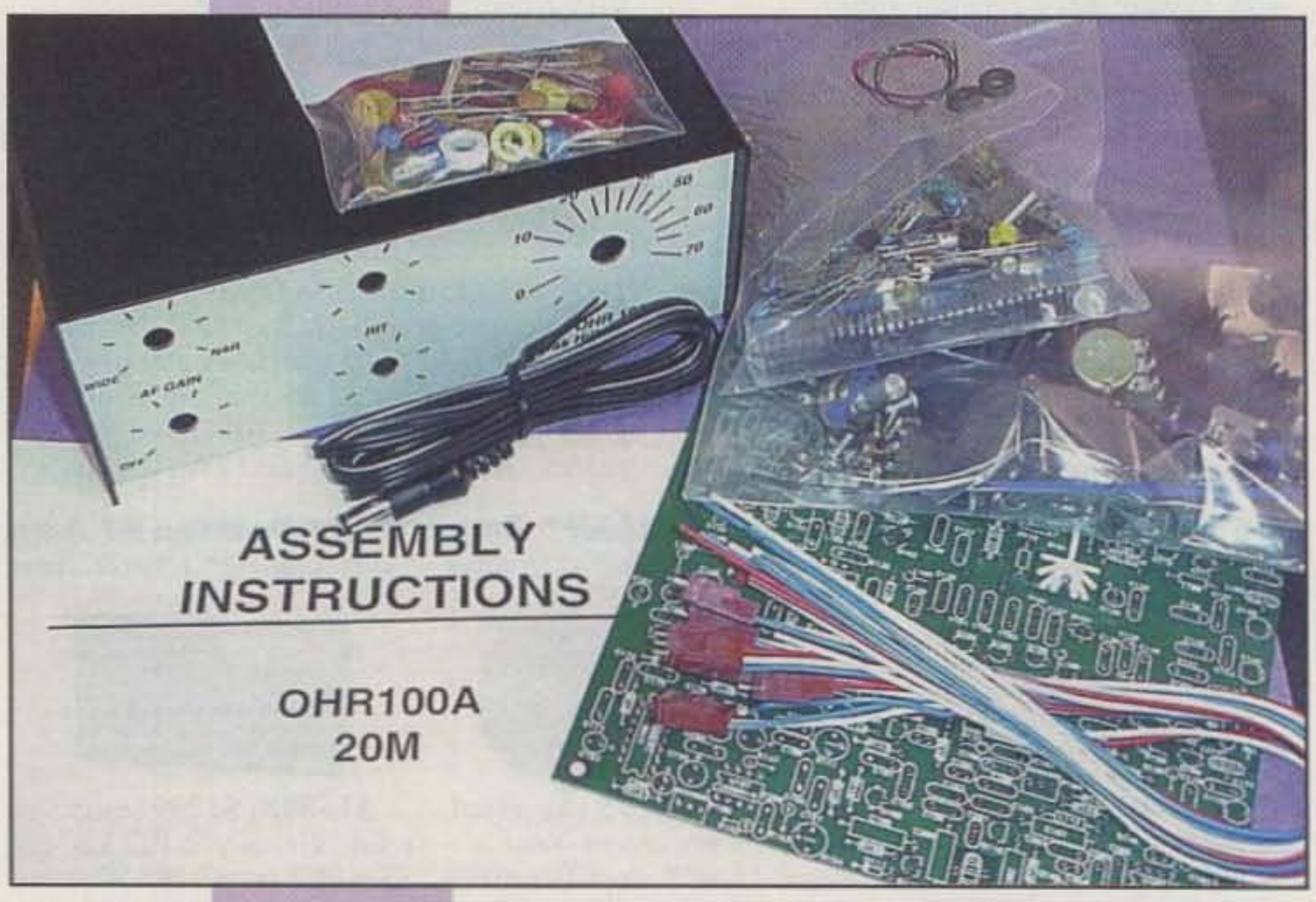

Photo 2– This is how an OHR100A looks as received and laid out prior to assembly. Board is silk-screened with parts locations easily visible and has plated-through holes to ensure solid connections.

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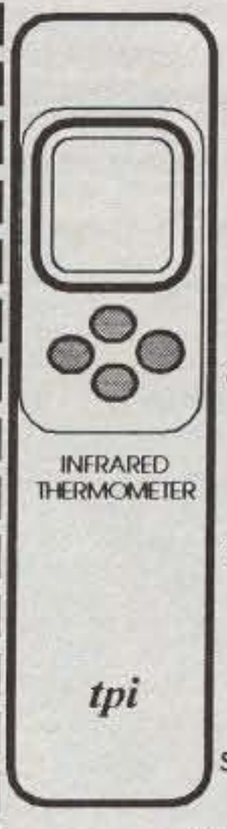
difference signal in each case is a 9.0 MHz IF). Now let's fill in some of the hole" in that description and bring in some of the 100A's neat operating assets.

The transceiver sports separate RF and AF gain controls, plus its IF bandwidth is continuously adjustable from 1200 Hz to around 400 Hz. RIT is included, with a center-detent control eliminating the need for a separate RIT on/off switch. Output power is also adjustable from 5 watts down to a few milliwatts, and the rig's break-in operation is quite smooth without thumps or pops. Input current requirements (at 13.6 volts DC) are 80 ma receive and 850 ma transmit, making the OHR 100A an attractive hiking or traveling companion. Options for the little rig include an internally-mounting iambic keyer and a precision 10-turn main tuning potentiometer for super bandspread.

Approximately 100 parts make up an OHR100A, placing it in what I would call the easy-brew category. In fact, Marshall Emm reports a number of "first-time homebrewers" have successfully built the transceivers. The kit is supplied complete with all parts, sockets, knobs, and a prelabeled cabinet—one stop shopping, you might say (photo 2). Marshall estimates total carton-to-completion time at around 10 to 12 hours, which includes winding a few toroids, mounting the rig in its cabinet, and aligning it (photos 3 and 4). Alignment, incidentally, requires only a digital voltmeter and a frequency counter or general-coverage receiver with a digital dial for accurate readout. We also understand OHR100As can be "built to order" for time-deprived amateurs. Judging by the number of folks I have heard or worked using OHR100As, I would say they do a very good job in QRP.

More Oaks

If we step back and look at the full Oak Hills Research line, several more kits warrant favorable mention. These items include a 6-digit frequency counter or digital dial, the 5-band OHR500 CW transceiver shown in photo 5, and the WM2 QRP wattmeter shown in photo 6. The wattmeter is especially popular among serious QRPers, as it measures forward and reflected power from 10 watts down to 5 milliwatts in three ranges (10 watts, 1 watt, and 100 mw). A digital voltmeter is all that's required for alignment, and accuracy is within 5 percent. More details (and kits!) are available directly from Oak Hills Research and/or the Morse Express, 2460 South Moline Way, Aurora, CO 8001-1833 (tele-



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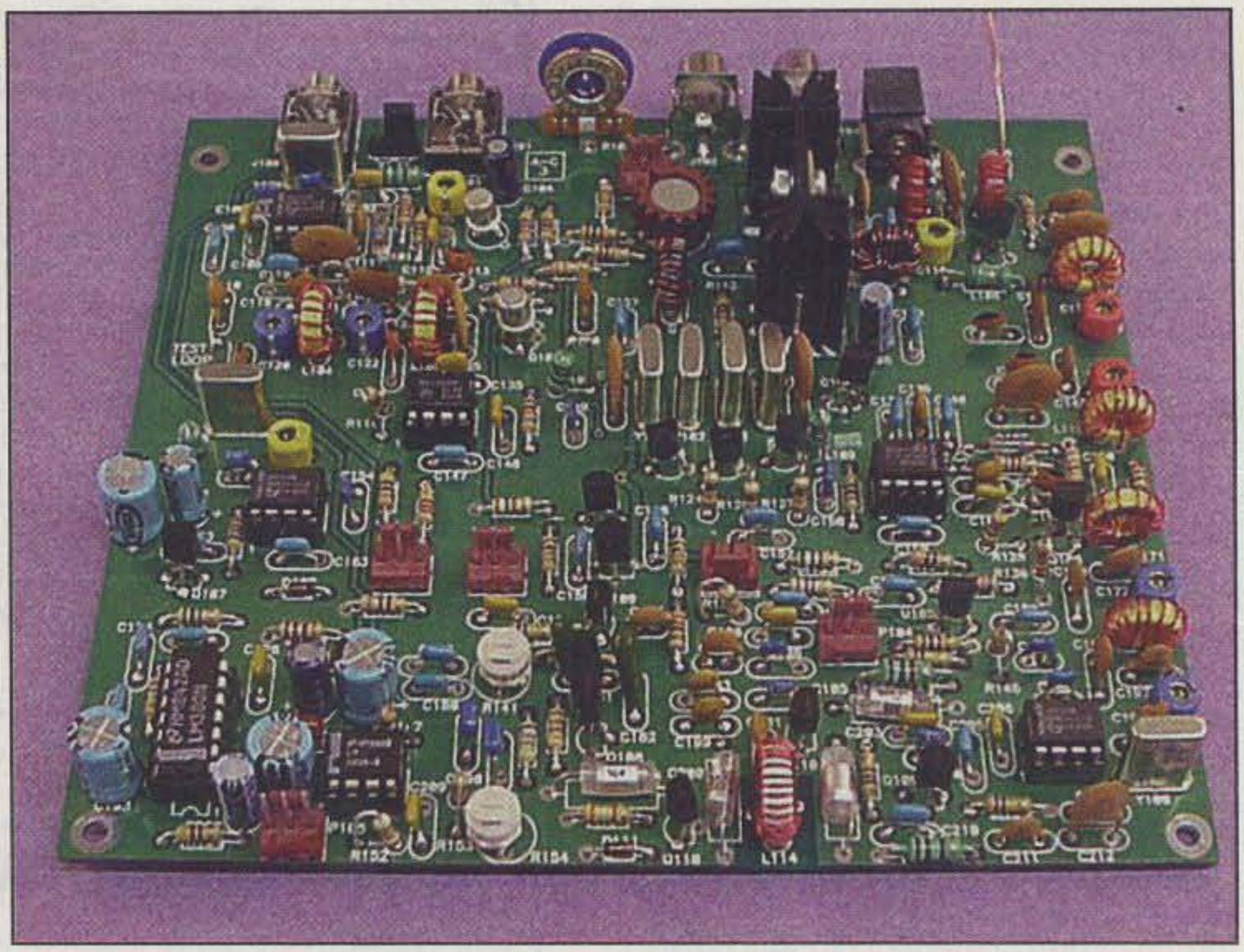

Photo 3– The OHR100A after all coils have been wound and all parts have been mounted on the PC board.

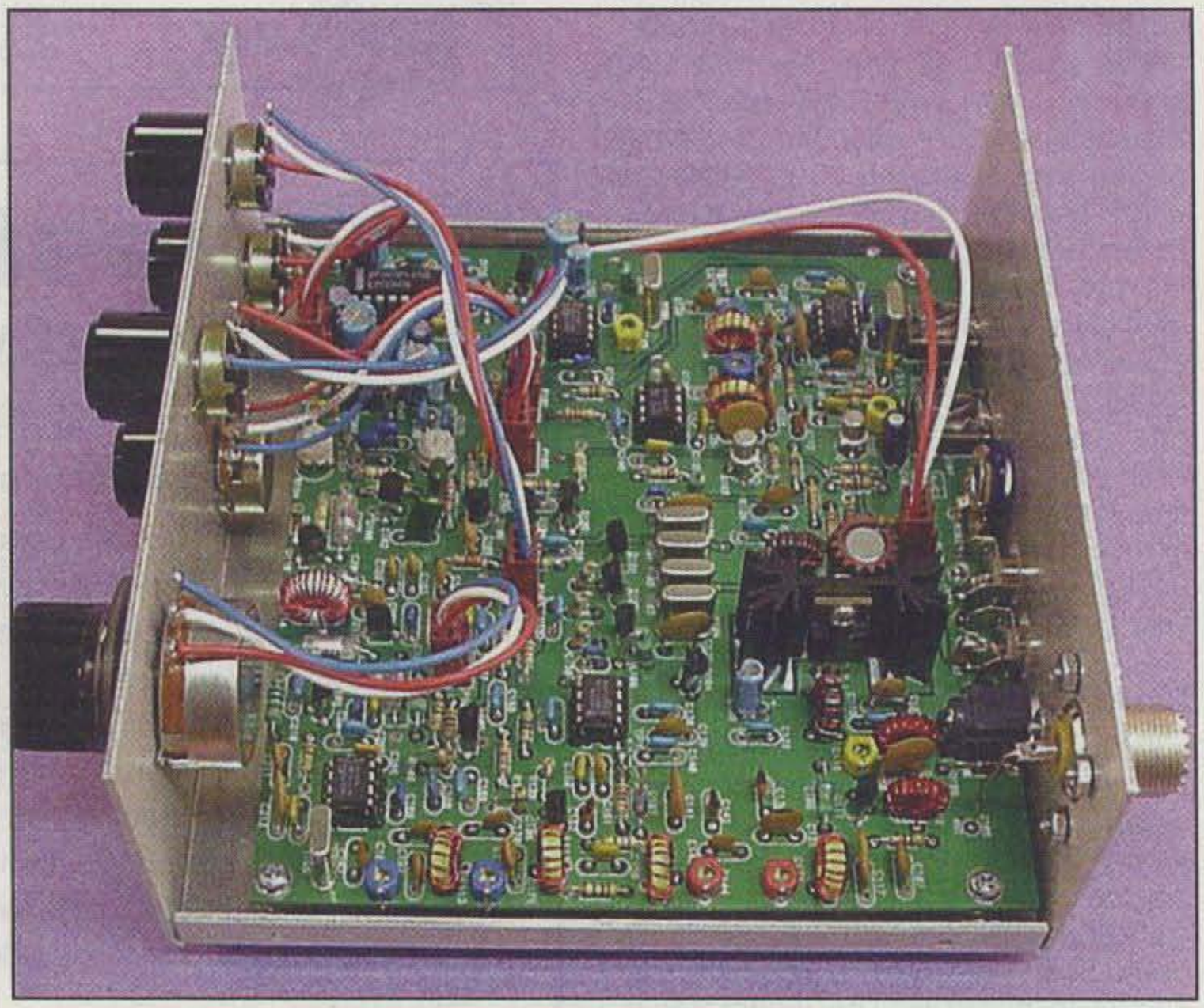

Photo 4– The fully assembled OHR100A with upper section of cabinet removed for checkout and alignment. Notice only off-board parts are front controls and rear antenna socket. (Photo by N1FN)

phone 303-752-3382, orders 1-800-238-8205, or online at <www.MorseX.com>. Check them out!

Homebrew Haven

If you like laying out and building your own projects to fill specific needs or application, take a look at the new *QRP Projects from Down Under* book written by Drew Diamond, VK3XU, and published by MFJ Enterprises. The book contains circuit diagrams and details on

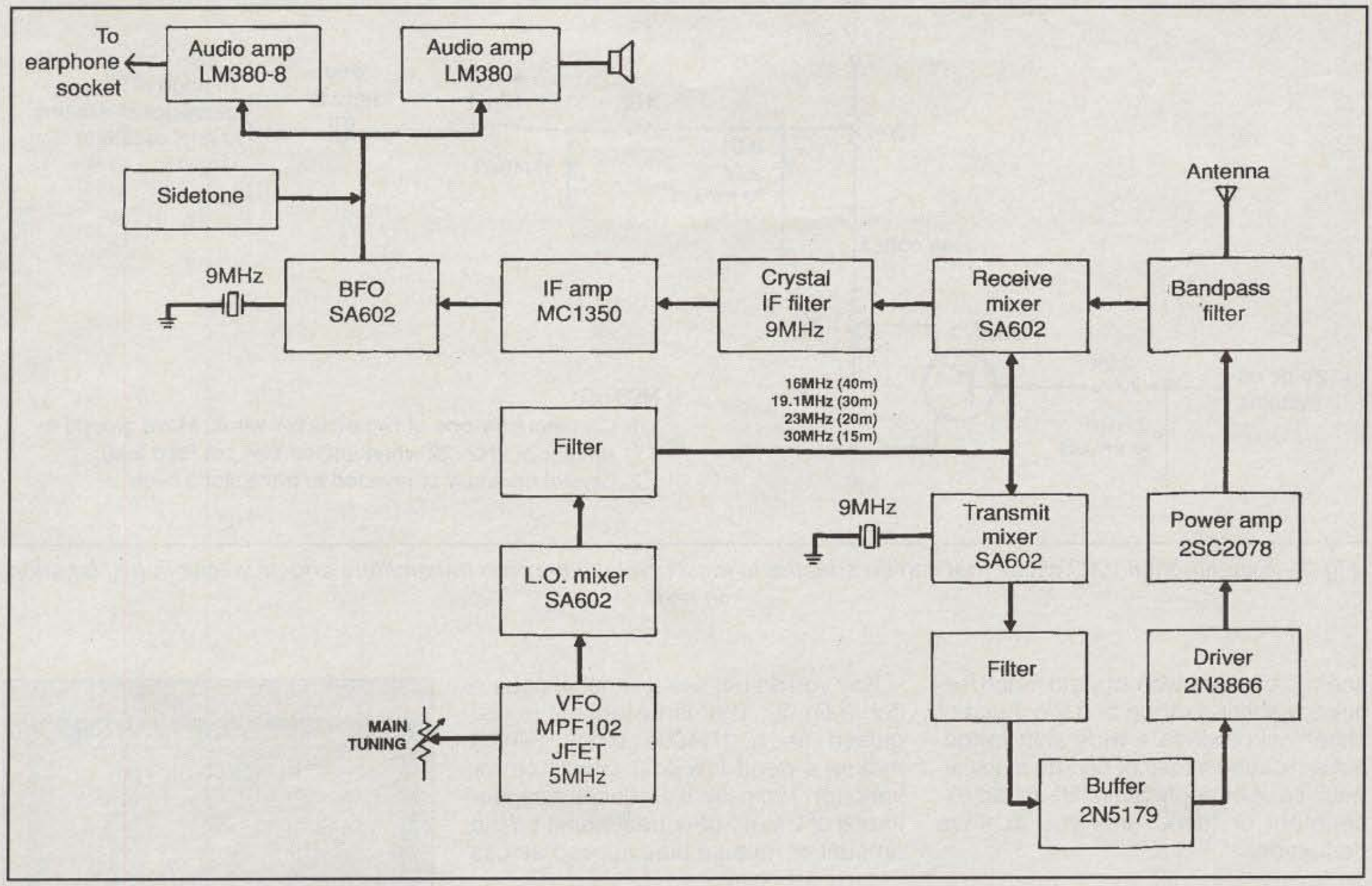

Fig. 1– Simplified block diagram of the Oak Hills Research OHR100A QRP transceiver (discussion in text). (Figure courtesy N1FN)

a variety of receivers, transmitters, transceivers, and test equipment you can assemble on perfboard, tagboard, or Manhattan style, as desired. Some neat, clever ideas that you can adapt to other projects or integrate into your own circuit plans are included in a number of the book's projects, making it extra appealing. Using a surplus computer-type 40 MHz crystal oscillator module and an NE602 to produce a quick-brew receive converter is one example. Adding one or two frequency doubler stages to an 80 meter transmitter so it covers 40 or 20 meters is another example. Also included are two circuits that interface IRF510 MOSFET amplifier stages to 2N3053 stages for pumping up the output of little 2 watt rigs. If you yearn for even more power, the book has full information on a "2 watts in, 25 watts out" power MOSFET amplifier you can build at home. The book strikes me as a proverbial gold mine of good ideas and homebrew projects that have been proven to work and are easy to duplicate. Copies of *QRP Projects From Down Under* are available from MFJ Enterprises (order line 1-800-647-1800) and/or amateur radio dealers nationwide.

Photo 5– The five-band OHR500 transceiver. Unit is quite popular among QRPers and gives a good account of itself on the air.

Dinkin' Notes

Now moving into our third category of the month, we have a couple of handy ideas and tips to share with you. First is an easy to integrate arrangement for including VXO control in a crystal oscillator circuit (fig. 2). Basically, this frequency warping "mod" involves connecting a small coil or molded inductor and a small variable capacitor or varicap in series with the crystal's negative lead. The coil/inductor's value will usually be between 4.7 and 12.0 microHenry, depending on the band, crystal cut, and desired range. The capacitor's value will likewise be between 20 and 100 pFd.

How can you recognize proper values of inductance and capacitance? First, keep them balanced rather than a "lot of one and a little of the other." Second, just understand not

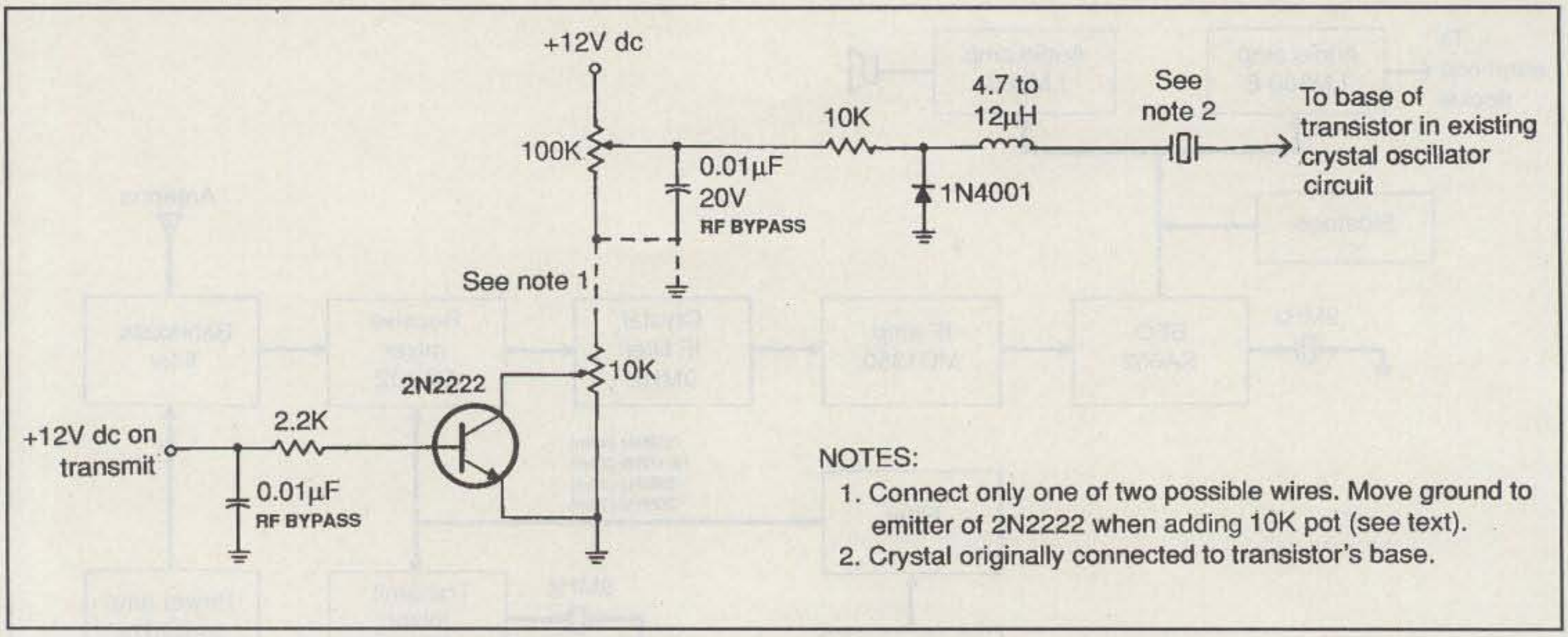

Fig. 2– Experimental VXO circuit that can be adapted to most crystal-controlled transmitters and/or receivers (explanation in text).

enough of either will not yield much frequency shifting range and too much of either will produce a wide shift range, but will cause a loss of crystal stability. Each case or application differs, so experiment or "dink" until you achieve perfection.

Say you do not see a variable capacitor in fig. 2? That is because it is disguised as a 1N4001 diode (which makes a good low-cost substitute for varicap). Typically, it produces a capacitance of 2 to 40 pFd, depending on the amount of reverse bias applied across its PN junction. That biasing voltage in turn can be acquired by connecting a 100K ohm pot across a 9 or 12 volt buss line. Add a 10K resistor in series with the pot's wiper to avoid applying full voltage to the diode, and a include a .01 mFd capacitor for bypassing stray RF energy to ground, and enjoy new frequency agility. Molded inductors (such as part numbers 542-78F1RO for 1.0 µHy or 542-78F4R7 for 4.7 µHz) and 1N4001 diodes (or small trimmer caps, if desired) are readily available from Mouser Electronics, 956 N. Main, Mansfield, TX 7606341 (1-800-346-6873).

Photo 6– The Oak Hills WM2 wattmeter reads power right down to the 5 milliwatt level with good accuracy. Nice!

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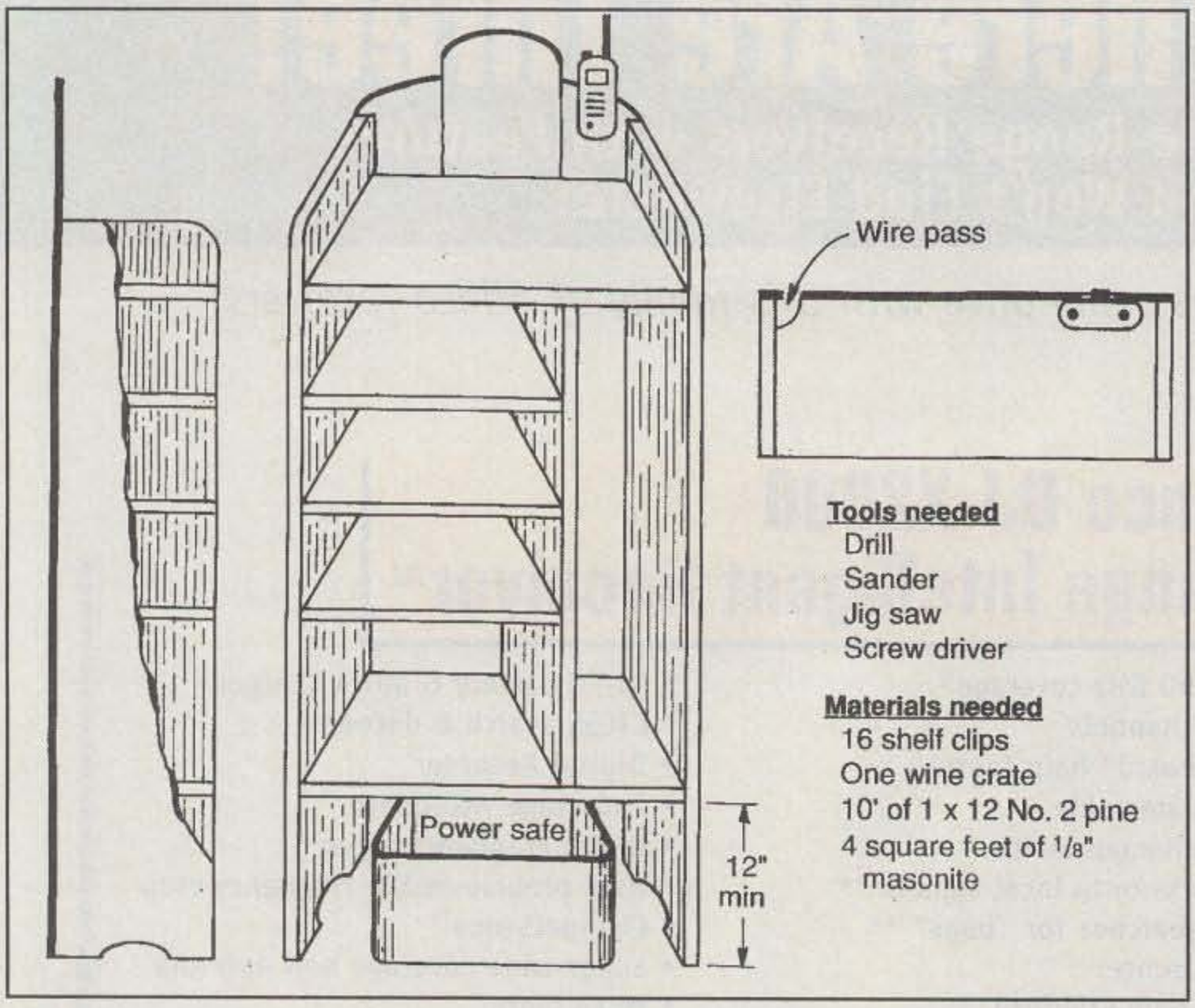

Fig. 3– Outline of a "build it to fit your needs" rig stand or easy chair ham shack from Roger Hall, KC6QLB. Unit's sides plus top and bottom shelves are 1 inch thick by 12 inch wide pine board. Inner shelves are masonite and rear backing is cut from a salvaged wine case. Wine cases are thin, yet strong. A substitute is 1/8 inch plywood. Tailor all dimensions to your gear. (Figure courtesy KC6QLB)

The one transistor circuit inside the dotted lines of fig. 2 is another dink idea you might like to try. It is a simple TX offset arrangement so your signal does not appear zero beat (and thus unheard) by another station. Simply explained, the 10K pot sets the amount of frequency offset while the 2N2222 shorts out the pot on transmit. It is tricky to adjust, but it works! The transistor's 2.2K resistor limits base current and its .01 mFd capacitor bypasses stray RF energy.

Looking in a more mechanical direction, we have some flexible "build it your way" plans for a miniature rig stand or "easy chair ham shack" from Roger Hall, KC6QLB (fig. 3). Roger, as you may know, is the man behind Cutting Edge Enterprises, the firm producing those spiffy rig carry cases, pouches, and portable power packs advertised here in *CQ*. His rig stand is build from a 10 foot piece of 12 inch wide by 1 inch thick pine wood, a surplus wine crate, and some sections of masonite. The stand is approximately 30 inches tall, with its masonite shelves cut and adjusted in width and height to mate with your particular gear and easy chair. Bear in mind the outline in fig. 3 is only a "starting point." Build it to fit your needs. Study the sketches and compare Roger's suggested shelf heights of 12 to 25 inches above the floor with the space beside your chair to see the hidden beauty of this project. Build one and then take some photos of your mini station in operation and we may spotlight you here in a future column.

Wrap Up

That winds down the news and views for this time, gang, and I trust it has inspired your enthusiasm for working more QRP. The thrill and exhilaration of hearing a DX station return to your call when running low power is unequaled, and QRPers are some of the most terrific folks in amateur radio. Listen or join us (using low power, please!) around 14.060 MHz during weekends and you will surely agree. We may not blow the bands apart with strong signals, but we have a barrel of fun!

73, Dave, K4TWJ

Your Time in The Spotlight

Are you active in QRP? Do you have a special rig or dink project others would enjoy seeing? Maybe you wrangled some noteworthy contacts or worked some unusual DX with QRP during the last few months. Well friend, this is your personal invitation to enjoy some well-deserved time in the spotlight. Shy, are you? A classic old proverb asks "If a tree falls in the forest and there is no one around to hear it, does it make any noise?" That same philosophy holds credit here. You may be accomplishing admirable feats in QRP but if no one else knows of it, the gratification is lost like a whisper in the forest. What to do? Just mail me your photos and notes like N1FN and KC6QLB did this month, and I will "take it from there." Fair enough? Do it!

—Dave, K4TWJ

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in Florida and two in North Carolina, have been asked to provide the FCC with any proof of coordination they may have, along with details of how they have tried to resolve the interference complaints against them.

Reconsideration Requested On MURS

Motorola and the Personal Radio Steering Group (PRSG) have petitioned the FCC to reconsider its near-secret creation of the Multi Use Radio System (MURS) last year (see December 2000, *CQ*, "Zero Bias" and "Washington Readout"). MURS is a license-free service that allows voice, digital, and video transmissions with up to 2 watts effective radiated power on five VHF frequencies previously allocated for business band use.

According to the *W5YI Report*, Motorola asked the FCC to limit use of the new service to business communications only, and to prohibit phone patching via MURS. Motorola says it envisions the development of 2 watt cordless phones that provide service—and interference—for miles from a base station (this is already a growing problem in Asia, as we've reported on our website news page). Motorola also wants a prohibition on marketing radios that combine both MURS and non-MURS frequencies, precluding the possibility of manufacturers retuning amateur dual-banders for MURS (VHF) and Family Radio Service (UHF) communications on a single transceiver.

PRSG, meanwhile, has different concerns. PRSG is an organization of licensees in the General Mobile Radio Service (GMRS). It feels that consumers won't understand effective radiated power and will unknowingly use either too little or too much power (say, by connecting their handheld to a high-gain antenna), and asks that the 2 watt ERP limit be replaced by a 2 watt transmitter output power limit, which it says will be easier to understand and comply with. PRSG also wants prohibitions on phone patching, as well as "repeater-like" functions; and feels limits on antenna height are needed as well.

The FCC had not responded to the petitions at press time.

Increased Postage and QSL Costs

You probably noticed that the cost of a first-class stamp in the US went up from 33 cents to 34 cents on January 7. The only good news is that the cost of mailing a postcard remains at 20 cents, and that postage for additional ounces over one ounce on a first class letter drop from 22 to 21 cents. This means the cost of a 1–2 ounce letter remains at 55 cents. The really bad news, though, is in the cost of international postage and International Reply Coupons (IRCs). See this month's "DXing" column for details on these new rates.

Local CB Enforcement Bill Now Law

Before leaving office, President Clinton signed into law the bill passed by Congress (with ARRL support) allowing state and local governments, as well as the FCC, to enforce laws against illegal CB operation, including illegal amplifiers and RF interference. Amateur radio operators and all other FCC licensees are exempt from this new law, PL 106-521, according to the *ARRL Letter,* which adds that state and local laws passed under this regulation must specify this exemption.

(CQ *remains concerned that many amateurs will still run the risk of being hauled into court on the basis of these local regulations by well-meaning law-enforcement officials who don't know the difference between amateur and CB radios. While such cases will no doubt be thrown out in court, there is still a danger that many hams will have to incur legal expenses to protect themselves.—ed.)*

German Packet Protest Tied to Code Rules

A protest by German packet network operators appears to be tied to a debate over code requirements for licensing in that country. While Germany was a leader in dropping code requirements for VHF licenses, its national organization, the DARC, has continued to support code for HF privileges (as does the ARRL in the US; see above). Apparently, code opponents in Germany had been using the packet network to send bulletins critical of DARC, a position with which a majority of packet system operators seem to disagree. According to "Newsline," the sysops decided to deny access to the anti-code group, which promptly complained to the government. The government responded by proposing rules which would require all legal communications to be carried, and the packet sysops responded by going on strike and temporarily shutting down the country's vaunted high-speed packet network. The sysops claim that their stations, and the entire packet network, are private, and that they may decide what will and will not be carried on them. The situation remained unresolved at press time.

Australian 70 cm Update

Here's an update on the 70 cm band in Australia, which was "borrowed" from hams during the Olympic Games in Sydney last year. "Newsline" passes on a "Q-News" report that most Australian hams regained the use of 440–450 MHz on November 1, 2000, while "the lower part of the band" would be returned as of January 1, 2001. It's unclear whether this is a change to our previous reports ("Ham Radio News," December issue; "Op-Ed," January issue) that the 420–430 MHz segment of the 70 cm band had been permanently removed as an amateur allocation.

UK Hams Get 73 kHz for Three More Years

The British Radiocommunications Agency has granted a three-year extension to a temporary authorization for experimental amateur operation on 73 kHz. The *ARRL Letter* reports that the VLF experiment was extended because of problems with a high noise floor and the desire to study how propagation there is affected by the current high level of solar flare activity.

Two CQ "Family" Silent Keys

Two prominent hams with *CQ* "family ties" passed away in November. Well-known electronics author Joe Carr, K4IPV, died November 25 at age 56. He was Antenna Editor for our sister magazine *Popular Communications,* as well as an occasional author and behind-the-scenes antenna advisor for *CQ.* He wrote hundreds of articles for a variety of electronics magazines, plus over 100 books. Joe's *Practical Antenna Handbook* is always within arm's reach on your editor's bookshelf; and Joe was always pleased to answer a question or help solve a reader's problem. We will miss him.

Steve Affens, K3SA, former webmaster for *CQ Contest* magazine, passed away November 28 on a trip to the Cayman Islands. He and his wife went to the Caribbean islands for the CQ World-Wide DX CW Contest (he operated as ZF2SA) and to celebrate their 30th anniversary. He reportedly suffered a heart attack.

Hatfield Retires From FCC

Dale Hatfield, NØIFO, has retired as head of the FCC's Office of Engineering and Technology, and, according to the *ARRL Letter,* hopes to return to his previous position, teaching telecommunications at the University of Colorado at Boulder. One of the few high-ranking hams at the FCC, Hatfield made news among amateurs last year when he laid out a blueprint for keeping amateur radio thriving and relevant in the 21st century (see September 2000 *CQ* for details).

Additional and updated news is available on the Ham Radio News page of the CQ website at <http://www.cq-amateur-radio.com>. For breaking news stories, plus info on additional items of interest, sign up for CQ's free online newsletter service. Just click on "CQ Newsletter" on the home page of our website.

Revenge is sweet, they say ... So WD8DAS, frustrated as a teenager by radio projects requiring a well-stocked junkbox, has spent 30 years building up his junkbox. Now it's his turn to be the source of wistful frustration to those without well-stocked junkboxes (or those junkboxes that contain only multi-legged pieces of black silicon).

The "Secret Dream" Transmitter

BY STEVE JOHNSTON,* WD8DAS

The WD8DAS "Secret Dream" transmitter, built entirely with junkbox parts on a real breadboard. Be sure to read or review the safety precautions (in text) for working around open circuitry.

When I was a teenager in the 1970s, constructing electronic projects could be frustrating. The once-common full-line radio parts shops had closed and with them went the easiest sources of parts for the radio devices I wanted to build. It didn't help that the books and magazines I was reading were filled with projects built with 1950s and '60s parts. The only parts store left open, RadioShack, had only a limited selection of modern items and virtually nothing "old-fashioned."

Nearly every electronic construction article mentioned that some of the parts would be found in the reader's "junk-box." This rather mysterious box, not unlike Pandora's, held the important stuff needed for the project. Self-reliance is a great thing , but as a beginner without a well-stocked "junkbox," most of my building plans were dead in the water.

My secret dream has been that one day I would be able to build complete projects without the hassle and delay of buying parts. To combat this frustration, over the years I've tended to collect inexpensive parts and equipment from hamfests, auctions, estate sales, and the like, organizing them for future use. I haven't been a maniac about it; cross-country moves, forays into other hobbies, and the growth of our family have limited the size of my "junk-box" (although my wife might disagree).

To keep the cost reasonable, I focused my efforts on older parts. Along the way I've put my stock to good use as I repaired and restored classic radio gear, but I continued to find I still needed to order parts to build anything from scratch. Would the day ever come when I could get an idea and just build it?

*3350 Oakham Drive, York, PA 17402
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The Tingle, the Itch, The Challenge

Then it happened. Some friends and I were swapping e-mail messages about building some very simple CW transmitters from 2N2222 transistors. I'm known for my love of vintage radio gear, so I felt obliged to jokingly reply that I should build an equivalent tube rig just to be different. Then I felt the tingle, the itch ... I started to look back over my books and magazines ... I found myself lingering in the garage staring at my "junk" collection. Could I do it? Had I finally reached the point where I could fulfill my "secret dream"? Could I design and build a tube rig using parts already on hand?

The first task was to design a simple, effective CW rig using vintage parts. My research sources for the project included the following:

- 1962 RCA TT-5 *Transmitting Tube Manual*
- ARRL *Handbooks* of 1945, '50, '59, '66, and '75
- *Radio* Magazine/*Editors and Engineers Radio Handbooks* from 1938–1975
- ARRL's 1971 *Understanding Amateur Radio*

The latter is one of my most cherished books on ham radio. When I was start-

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ing out as a Novice, I read *Understanding Amateur Radio* over and over. It was, and still is, great.

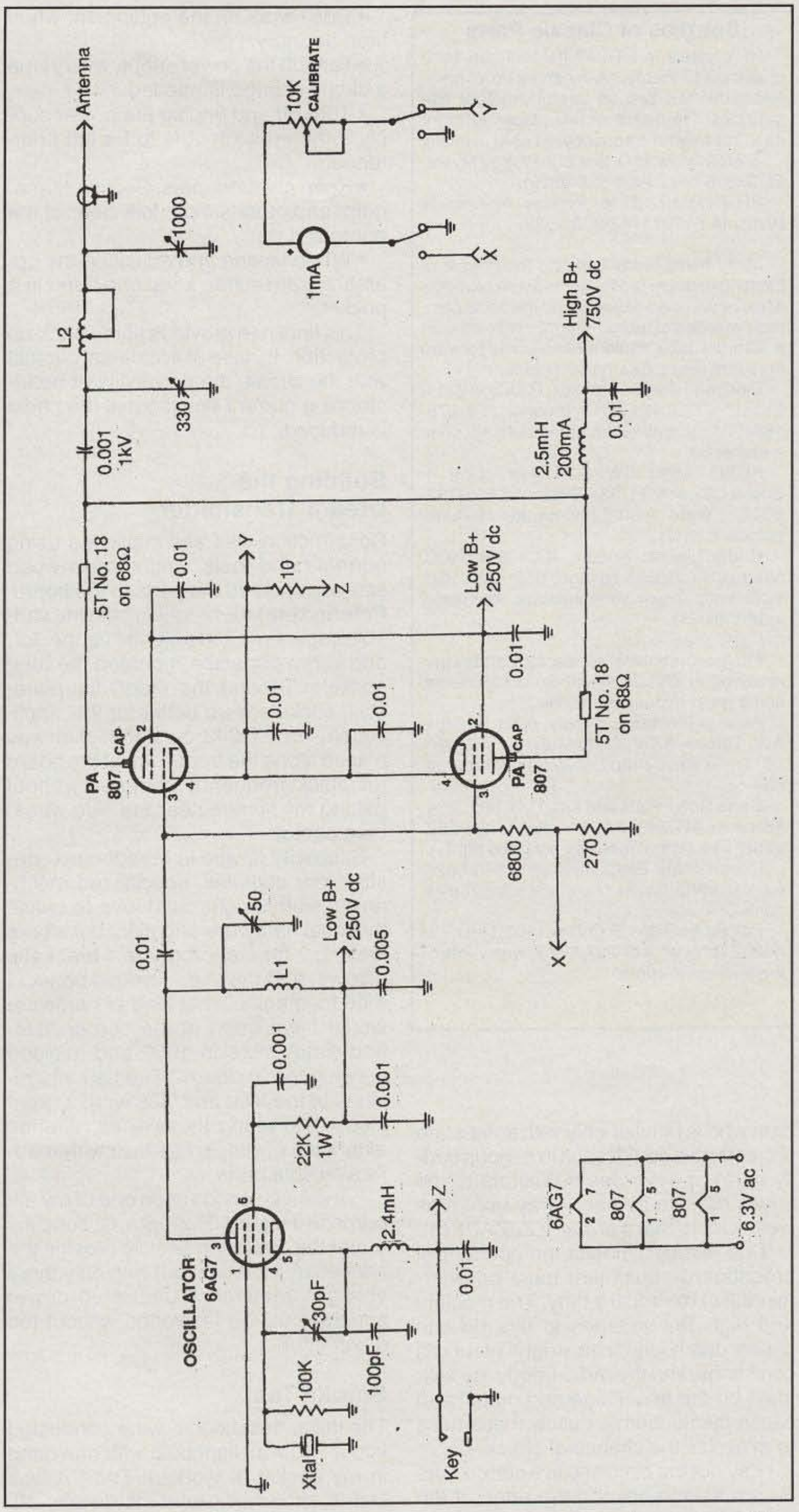
In keeping with the goals of simplicity and nostalgia, I envisioned a transmitter such as a beginner would have built in the mid-to-late 1950s. As I perused the journals, this idea gelled into a design based on an electron-coupled Colpitts crystal oscillator using a 6AG7 metal tube and a dual-807 power amplifier. The only semi-modern feature would be a pi-network as the PA tank circuit (see schematic). Band-switching was considered—and rejected. The prototype would be built for 40 meters, and if successful, plug-in oscillator coils and the movable tap on the PA tank coil could be used later to allow band changes. Cathode keying is one of the simplest ways to put some intelligence on the carrier, so it seemed the logical choice for this design.

My choice of chassis was a major turning point in the project. I'd selected a metal chassis and a very professional-looking instrument case from the garage when I realized I would be hiding the best parts of the rig inside a relatively featureless cabinet. Why not build it out in the open on a wooden breadboard? That had been, after all, a common construction technique for simple, beginners' tube transmitters. I changed gears, put away the metal chassis and case, and went up to the kitchen. There I found an 8.5" × 13" wooden breadboard with nicely turned edges. It was ready-made for the task; absolutely no further cutting or sanding was needed. (*But, Steve, did you need any special tools to pry it out of your wife's hands?—ed.*)

Building the rig on a breadboard made a lot of sense in this application. It gave me an excuse to use the components that have the sexy vintage radio "look," such as cloth-covered wire, copper buss bars, transmitting caps, and the like. The elegant shape and polished glass of the Canadian-Westinghouse 807 power amplifier (PA) tubes would really catch the eye.

Safety First

Putting artistic concerns aside for the moment, it is important to realize there are serious safety drawbacks to this construction method. The finished product is intrinsically hazardous, with high voltage and RF exposed right out in the open. This won't stop a real ham who is aware of the risks and treats the equipment with due respect, but for an appliance-operator, or even a serious



The schematic for WD8DAS's junkbox transmitter. Note that the output of the two 807s is via the tube caps. Don't have these parts in your junkbox? See the author's extensive source list for buying vintage parts, or dig out some old radio handbooks and modify the design to make use of what you do have available.

Sources of Classic Parts

HF crystals in FT-243 holders can be a challenge to locate. Many show up at hamfests, but few are on useful amateur frequencies! I'm aware of two places to order new, cut-to-your-frequency, FT-243 crystals:

JAN Crystals, P.O. Box 60017, Fort Myers, FL 33906-6017 (800-526-9825).

PR Crystals, 2735 Avenue A, Council Bluffs, IA 51501 (712-323-7539).

Many hams today bemoan the trouble of locating vacuum tubes, but in some respects it has never been easier to find the once-common varieties of tubes. A number of excellent mail-order tube dealers have come forward in recent years. Examples include...

Electron Tube Enterprises, P.O. Box 8311, Essex, VT 05451-8311 (phone: 802-879-1844; on the web: <http://members.aol.com/etetubes/>).

ERSC, 1599 SW 30th Ave., Unit 4, Boynton Beach, FL 33426 (phone: 561-737-8044; web: <http://home.att.net/~esrc/esrcmain.html>).

Radio Electric Supply, P.O. Box 1939, Melrose FL 32666 (phone: 352-475-1950; web: <http://www.vacuumtubes.net/npage/indexc.html>).

For tubes, sockets, connectors, and many, many other classic electronic components, some great resources include...

Antique Electronic Supply, 6221 S Maple Ave, Tempe, AZ 85283 (telephone: 480-820-5411; web: <http://www.tubesandmore.com/>).

Dan's Small Parts and Kits, P.O. Box 3634, Missoula, MT 59806-3634 (phone: 406-258-2782; web: <http://www.fix.net/dans.html>).

Ocean State Electronics (800-866-6626; web: <http://www.oceanstateelectronics.com/>).

Fair Radio Sales, P.O. Box 1105, Lima, OH 45802 (phone: 419-227-6573; web: <http://www.fairradio.com>).

ham who is familiar only with solid-state projects, this could result in serious bodily harm or even death. Visitors to the shack have to be kept away from it as well ("Oooh, that's pretty" ZZZZAPPP!).

"Due respect" means the operator of breadboard equipment must be ever-mindful of electrical safety. The medium and high DC voltages in this rig can cause death under the right (wrong?) conditions, and the radio-frequency voltages on the final stage and output can cause painful burns. Follow these rules to minimize the chance of shock:

- Lay out the circuit so live conductors do not extend beyond the edge of the breadboard.
- Use insulated wire and spaghetti tubing to minimize points with exposed voltage.
- Don't work on the equipment when tired or angry.
- Turn off the power supply *every* time a circuit change is needed.
- Turn off and unplug the power supply if the equipment is to be left unattended.
- Keep children, pets, Section Managers, and other simple folk clear of the energized rig.
- When testing and adjusting the operating transmitter, keep one hand in a pocket.

This final rule provides some back-up protection; in case of accidental contact with the circuit, the possibility of heart-stopping current flow across the chest is reduced.

Building the Dream Transmitter

Construction was accomplished using normal hand tools. Bright-brass wood screws mounted the parts to the board. Polished brass L-brackets held the variable capacitors and antenna connector, and screws/spacers mounted the tube sockets. I found the older, flat-plate-style sockets were better for this application. An FT-243 crystal socket was placed along the front edge of the board for quick frequency changes without getting my fingers near the "live wires" (see photo).

Simplicity is vital in breadboard construction; complex, specialized mechanical stuff is right out! I love to cruise the local hardware and discount stores looking for appropriate brackets, screws, and the like. For this project I tried to imagine what kind of hardware would have been at the corner "five-and-dime" store in 1950 and avoided thinking too "modern." The ham magazines of the '40s and '50s were a great inspiration along these lines, offering examples of simple rigs built with readily available parts.

For convenience I used one of my all-purpose Heath HP-23 power supplies under the operating desk to provide the necessary voltages, but with only three voltages required a dedicated power supply could be fashioned without too much effort.

Smoke Test

The initial "test firings" were conducted into a 100 watt light bulb with one hand in my pocket. It worked! The PA was stable, showing no tendency to take-off, and the oscillator ran loud and proud and did not stall under any condition of tuning. Listening on a nearby receiver, I discovered key-clicks were not a problem, and while I could hear some chirp, it was not as bad as some commercial designs. It also was much better than most homebrew solid-state rigs of similar simple design.

I noticed the greatest shift in the oscillator frequency coincided with the PA tuning and loading being adjusted for peak output. This indicated that the chirp was due more to the power supply voltage sagging a bit at full power than the changing load on the oscillator. Switching to a well-regulated low B+ supply for the oscillator took care of that problem. Perhaps one day I'll add a colorful gas-regulator tube to the rig. For now, the stability is quite good for such a simple design.

The brightness of the lamp indicated I was getting significant power out. Moving the output to a wattmeter and a 50 ohm dummy load revealed it was making about 85 watts out at the optimum settings for both signal quality and quantity. The scope showed a smooth waveform low in harmonic energy.

The first on-air test was a snap. I tuned around the low end of 40 and heard a strapping signal calling CQ within a kilocycle or so of one of my crystals (*remember, it's a 1950s design; you have to use 1950s terminology—ed.*), so I gave him a call. Unlike my previous homebrew transmitters (all QRP), this transmitter has some significant RF output, so unless the other op is using a brick for a receiver, I should be heard. Since Paul, K2OFM, was using a fine old National receiver, he copied me 599. The QSO became all the more special when I learned Paul was also running a homebrew transmitter—a solid-state/tube hybrid. How appropriate!

Constructing this transmitter from scratch using parts on hand has given me more satisfaction than any hobby project in recent memory. My "secret dream" has been fulfilled.

What About You?

If reading this article has started that tingle, that itch, in you, there's no need to get frustrated the way I used to. If you want to build an exact duplicate, you may use the schematic and order whichever parts aren't in *your* junkbox from one of the sources listed in the sidebar. However, building *my* rig is not really what I had in mind in writing this article. My goal was to get your creative juices flowing, to get you digging out old handbooks and digging through your junkbox, then coming up with your own design based on what you have on hand. Have fun and good luck! ■

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VHF Plus

BY JOE LYNCH, N6CL

All About The World Above HF

ARISS On the Air—and Planning for the Future

Early in the morning on November 13th, Randy Shriver, KG3N, of Hanover, Pennsylvania, made the very first individual (informal) amateur radio contact with the International Space Station, putting ARISS (Amateur Radio on the International Space Station) officially on the air. Randy shares the story of this historic contact with us elsewhere in this issue. Congratulations, Randy!

While a longtime enthusiast of SAREX and Mir operations, Randy is just getting his feet into weak-signal operations, using the station he built specifically for space -station contacts. To date Randy has made at least one meteor-scatter contact, that with Joe Goggin, K9KNW, in EL95. Also, he has made two contacts off the moon, one each with Dave Blaschke, W5UN, and Gary Crabtree, KB8RQ. Randy said he was expecting to compete in the Jauary ARRL VHF Sweepstakes.

Television station WGAL-TV, Channel 8 in Lancaster included a report on Randy's ISS QSO in its newscasts. The Hanover *Evening Sun* also provided publicity for Randy, publishing a photo of his array and a very complimentary article of his accomplishments.

The crew of ISS is expected to be replaced this month. It is unknown at this time the extent of amateur radio operations that will be undertaken in the near future from the ISS.

ARISS Elects Officers and Approves New Equipment

Meeting between December 1–3, members of the ARISS organization approved by-laws and elected the group's first officers. Among those elected were Frank Bauer, KA3HDO, as the chairman the ARISS Board. Chosen as Vice Chair was European Subregional Working Group Chairman Gaston Bertels, ON4WF. ARRL Field and Educational Services Manager Rosalie White, K1STO, was elected Secretary-Treasurer. All officers will serve for two years. The ARISS organization exists to provide support for amateur radio activities aboard the International Space Station.

At the meeting approval was given for at least one more station on board the ISS. Roy Neal, K6DUE, reporting on *Newsline,* stated, "Russia's Chief Delegate, Sergej Samburov, RV3DR, was given approval to send up another station, using upgraded Mir hardware, next spring, to be installed in the Service Module. Slow Scan TV, being developed in the U.S. by a team led by Miles Mann, WF1F, with hardware support from Lou McFadin, W5DID, also should be activated at that time."

A high priority was given to contacting schools. It is the intention of ARISS to schedule contacts with a school a week once the routine of operations in the ISS has been established. The first school contact was scheduled for December 19, 2000 with the Burbank School in Burbank, Illinois. Casual contacts are expected to continue as time permits.

The ARRL announced that it will handle QSLing for U.S. amateurs who work the ISS amateur radio stations. Current callsigns for ISS include NA1SS, RSØISS, plus the operators' personal callsigns. Operating frequencies for routine ARISS operation are: Worldwide downlink for voice and packet, 145.800 MHz; worldwide packet uplink, 145.990 MHz; Region 1 (Europe/Africa) voice uplink, 145.200 MHz; Region 2 (North/South America) and 3 (Asia/Oceania) voice uplink, 144.490 MHz.

Mir (may be) Scuttled This Month

The Russian space station Mir may be sent out of orbit at the end of this month. The word *may* is used because while several news agencies reported in early November that the space station was scheduled to be deorbited late this month, the *Newsline* amateur news service reported that members of the Duma, the Russian parliament, voiced strong opposition to the destruction of the space station.

According to *Newsline,* "On Friday, November 24th, deputies in the parliament's Lower House overwhelmingly supported a motion condemning the premature end to operations aboard the Mir. The Duma said that the $60 million needed to keep Mir in orbit next year could be found in the federal budget. Russian lawmakers say the station provides employment for 100,000 scientists and engineers, and they do not want to see these jobs come to an end."

Even though the U.S. is pressuring Russia to scuttle the craft, claiming that resources being used for it could be used for the ISS, it may continue to fly on. Watch the *CQ* Website news page and the AMSAT News Service for the latest on this continuing story.

VHF Plus Calendar

February 5	Highest Moon declination.
February 8	Full Moon and perigee.
February 14	Last quarter Moon.
February 18	Lowest Moon declination.
February 21	Moon apogee.
February 23	New Moon.

• *EME conditions courtesy W5LUU*

FG/NØJK DXpedition Report

The following is from **Jon Jones, NØJK**: "Here is a summary of my FG/NØJK 6 and 2 meter 'DXpedition' to Guadeloupe. The station was active between 24–26 November. I operated from the QTH of FG5BG, the DX Shack, Rosseau Beach, Guadeloupe, FWI. The equipment I used included an ICOM IC706 MII, a 5-element M^2 antenna at 50 feet and aimed at North America and a 2-element rotatable quad at 15 feet.

"On 6 meters I made 102 QSOs in 16 countries. The countries include CE, CX, DJ, FY, HP, I, LU, OK, PA, PY, PY0F, S5, VE1, W, ZP, and 8P. The W/VE QSOs include VE1YX, VE1ZZ, W5EU, WD5K, W5OZI, W4UDH, N5WS, and K5IUA. Countries worked on 2 meters include FG and PY. My best QSOs include working PY5CC on 2 meters on November 27 at 0047 UTC. I used the 6 meter quad on 2 meters.

"Several Europeans e-mailed me that

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(phone 918-627-6625; fax 918-835-9785)
e-mail: <n6cl@cq-amateur-radio.com>

my FG 6 meter QSOs to EU were likely the first FG-EU 6M QSOs.

"I had one European opening on November 27, a short one that lasted between 1145–1220 UTC. The signals were very loud, especially S54G who was 599+. I worked 8P9HT on November 27 on *F2* backscatter and HP2CWB November 28 on 'TEP backscatter.'

"John, 8P9HT, was active from Barbados while I was in Guadeloupe and did a great job handing out over 300 8P 6 meter QSOs! *F2* conditions seemed different between FG and 8P. John had a much better opening to the states on November 28 than I did. He did not report any European QSOs November 27 during my opening to Europe. Our TEP conditions appeared similar.

"The 'DX Shack' does not have A/C, or running water yet (Georges is working on these), but it does have lots of hungry bugs. Kind of like Field Day. Still, the antennas do play!

"On the flight home I felt disappointed that my results did not compare with the hundreds of 6 meter QSOs made earlier this fall by W7XU in FY/8R and W6JKV's 50+ countries from VP2M. My conditions were just not as good. Still, the operators I worked were happy with a new one and overall I now feel the trip was worth the effort.

"A positive bonus was getting FG5BG on 6 meters on November 29. I had talked to and encouraged Georges to get on 6 meters this season, as it is the solar cycle peak and many still need FG on 6 meters. A visiting ham sometimes gets the natives 'stirred up.' Georges was on 6 meters November 29, and 'In a half hour, I had 47 US contacts, also Canada, one HC, K5, K7, W9, K6, KØ, N8, VE3.' His W6 QSOs are the first reported from FG. This probably would not have happened if I had not gone to FG. I guess that I am responsible in part for a total of around 150 6 meter QSOs from Guadeloupe this season. Georges' last prior reported 6 meter activity was February 2000.

"Some fan mail: 'Hello, dear Jon. Thanks for the QSO that we have yesterday (27-11-2000). Guadalupe is a new country for me (my 99th country for DXCC). Please tell me where to send my QSL card for you. 73 de Valentino, IW2JMC.'

"'Jon, glad you made it back ok. Thanks for the 6 meter QSO and also the CQ WW 28 MHz contact. FG is one of those countries that had always alluded me on 6 meters, so you were a new one for me, #117. But the next day, after our contact, also worked FG5BG. Your signal was very good into Texas for about an hour. That 706 and 5-element Yagi was really working. 73, J. B. Jenkins, W5EU.'

"'Thanks very much for a first PA-FG on 6 meters. FG was never worked before on 6 meters from the Netherlands. Thanks for the nice operation from FG. Was lucky to be at home for my lunch break. 73, D. I. Robbemond, PA7FM.'"

For more information on this trip and others by Jon, visit his URL at <http://communities.msn.com/6mdx>.

Propagation Reports

Victor Scarbro, KD5HPT (EM32), reports that on 5 September he had a brief opening on both 2 meters and 70 cm. He made contacts with KØMHE, WØLER, both in EN26. In addition, he had an *F2* opening on 6 meters on 18 September. On that day he worked PY5CC, PY5CQW, PY2LED, and 9Y4LAT.

John Butrovitch, W5UWB (EL17), reports that he had his first (and probably last) JA opening for this sunspot cycle from his remote location in south Texas. John had a brief, five minute opening the evening of 24 November (25th UTC). During that opening he worked JA1VOK and JF2ICB, both on CW. At the same time, he reported receiving two beacons from north of him: NØLL/B and K4OU/B, causing him to speculate that he had a sporadic-*E* link to the *F2* propagation that the West Coast boys were enjoying. John's station includes a 6-element Yagi at 65 feet and 1 KW out.

Ken Neubeck, WB2AMU, reports the following: "November has been an interesting month for 6 meters. There have been a number of *F2* openings with some sporadic-*E* openings sprinkled in with the *F2* openings. With the exception of one or two long-duration openings at the beginning of the month (November 6 and 7), most of the openings were typically 20–30 minutes long.

"On November 6, we worked TI5KD (EJ79). On November 7, *F2* was strong into the Caribbean and I managed to work TI5BX (EK60) and XE1KK (EK09). There were many other strong signals, with P43JB on CW, plus YV1DIG, HP1CWB, and TI5KD.

"The next few weeks saw brief openings here and there, but things started getting interesting again by the CQ WW weekend. In between my contest effort on 10 meters, I jumped to the 6 meter band and worked the following: November 25, GM4VEQ, IO51; HC8N, EI59; MMØAMW, IO51; WX7R, CN85; KB7WW, CN85; K7QXA, CN80; KC7HLP, CN85; WA7SDI, CN84; and NØXX/7, CN84, all on *F2*. It was interesting to see that we had the initial opening to Europe, an opening to the south, and then an opening to the west. On November 26, I worked the following: WB9M, EM40, and KK4TE, EM50, both on sporadic-*E*, and EI5FK, IO51, on *F2*. It was interesting to see that *F2* was present at the same time as sporadic-*E* on the 26th.

"On November 29 at 1717 UTC I worked PYØFF on 50.090 CW from my work QTH using a 2-element beam hung from a tree and 70 watts. The signals were weak but finally picked up enough that the contact could be completed.

"A few days later, on December 6, the band opened up during the weekend with the following: GW4YEQ, IO73; GM6NX, IO86; N6RA, CM87; W6QUV, CM98; W6KH, CM97; K6IPF, CN80; N9JIM/6, CM87; K7UU, CN87; VE7SL, CN88; VE7AGG, CN89; and NN7J, CN85. All of the contacts were made with either 70 watts and a vertical, 20 watts and a dipole, or 150 watts and a dipole."

John Lee, K6YK, reports the following propagation during November and December: "Here's a little 6 meter report from one of the *little* guns. A couple of big days for me recently! I am in CM-97. On November 7 the band opened to the west around 1915 UTC. The opening lasted a few minutes then came back around 2230. The stations I worked or heard included K6MIO/KH6, BK29, WH6XM, BK29, and KH6ND/KH5, AJ85 (this was both a new country and grid).

"On November 10, the band opened to the west around 2000 UTC. I again worked KH6ND/KH5. On November 25, the band opened but I missed the beginning of it. The last station I heard was around 1750 UTC. Stations heard/worked: VE1YX, FN74, W1CWU, FN42, K1DAM, FN41, VE9AA, FN65?, WZ1V, FN31, N1DPM, FN32, N1DVL, FN32, plus others that I forgot to write down in the FN area. I was unable to work K1DAM, who I need for WAS on 6 meters while running 10 watts or less. Next time!

"On November 28 the band opened to Costa Rica about 1630 UTC and the last station I heard was K6MIO/KH6 at

1836. Stations heard/worked: TI5KD, EJ79, HC8N, EI59, HP2CWB, FJ09, CO2KK, EL83, V31PC, EK56, ZF2NT, EK99, TI5BX, EK70, and K6MIO/KH6, BK29. The only U.S. station was K2RTH, EL95, loud and clear for a long time. No other American station was heard other than locals and a couple of backscatter signals from W7 and WØ.

"On November 29 the band opened to Costa Rica again about 1645 UTC and again the last station heard was K6MIO/KH6, at about 1840. (Seems to me that there is a pattern developing!) Stations heard/worked: TI5BX, EK70, K2RTH, EL95, YY4GLD, FK60, CO2KK, EL83, FG5BG, FK96, WP4G, EK68, YV4YC, EK60, ZF1DC, EK99, TI2LA, (missed the grid), and K6MIO/KH6, BK29. I heard more U.S. stations on backscatter this day, many *loud* W6 signals from southern California on backscatter.

"On November 30, I heard W6SKC/B from DM41 at 0350 UTC and TI2NA/B at 1550 UTC. I heard no other stations.

"On December 1, the band opened about 1540 UTC. The last station heard was TI2KI about 1615 UTC. Stations heard/worked, include: TI2KI, EJ89 and TI7WAM, EK70.

"Arnie Coro, CO2KK was running as low as 5 watts and a dipole at times. Bertie, WA6BXI, worked him with 10 watts from CM97, as well as working KH6ND/KH5 in November with 5 watts! QRPers, don't be discouraged. The propagation in November and December netted me three new countries and eight new grids!"

Europe-Africa 2 meter TEP Tests to Resume

Piero Baldelli-Boni, I5CTE, reports that his trans-equatorial propagation (TEP) tests with Kosie Du Buisson, V51E, were a complete failure. However, he indicated that Kosie is willing to have another go starting about February 20 until the end of March. The beacon frequency will remain the same (144.211 MHz).

Current Conferences

SVHFS Conference: The Southeastern VHF Society will host its Fifth Annual Conference April 20–21, 2001 at the Holiday Inn Select-Brentwood, in Nashville Tennessee. The program will include presentations by antenna specialist L. B. Cebik, W4RNL, EME enthusiast Bob McGraw, K4TAX, and many other VHF+ operators. In addition to the technical program/presentations and conference proceedings, there will be pre-amp noise-figure testing (50–1296 MHz), antenna gain measurements (144–2304 MHz), family program, fleamarket, vendor sales displays, the SVHFS auction, business meeting, Saturday night banquet with a guest speaker, K4UHF award presentation, and many door prizes. Pre-register for the conference by completing the registration form on the SVHFS website at <http://www.svhfs. org>. To be added to the SVHFS mailing list contact Robin Midgett, KB4IDC, via e-mail: <KB4IDC@arrl.net>.

The SVHFS mailing address is SVHFS Inc., P.O. Box 1255, Cornelia, GA 30531. Reservations for the Holiday Inn Brentwood may be made by contacting the hotel at 615-373-2600. The hotel website is found at <http://www.hotel-nashville.com/holidayinn>. The cut-off date for group rate of $80 per night is March 2, 2001. Mention the SVHFS 2001 Conference to get the group rate.

And Finally...

We are having a rare pre-winter snowstorm here in Tulsa while I am writing this column. It is fascinating to be cooped up inside. Normally, it would have given me the opportunity to get on the air, but I have to write a take-home final and clean up the house before getting on the air.

Having to be cooped up though has made me think about how thankful that I am for all that I have. I have a warm house, plenty of food, and the company of my wife. I also have a lot to be thankful for as a ham. I have friends all over the world, thanks to this hobby. I have the intellectual stimulation of learning new things, plus I have the challenges of accomplishment in working on the VHF+ ham bands.

Perhaps all of us should take a moment and think about what we have to be thankful for. If on your list is someone special, then the 14th of this month is a special day to remember to thank that someone special. I know that I will take some time to be with my wife, Carol, W6CL, on our third wedding anniversary. If you have something to share that you are thankful for that's appropriate for this column, please let me know. Until next month...

73, Joe, N6CL

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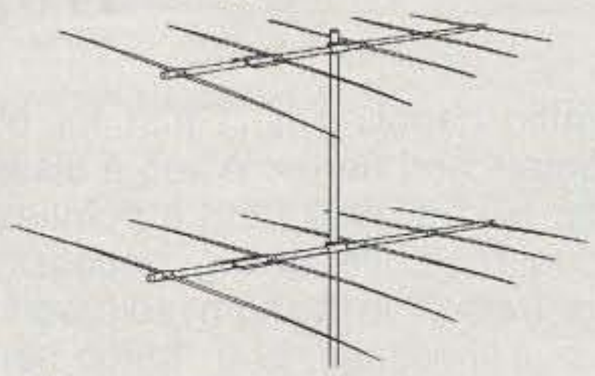

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Beginner's Corner

BY PETER O'DELL, WB2D

For the Newcomer to Ham Radio

Traffic Handling for Smart People

Traffic handling isn't just for old timers and nerds. When a disaster hits, it goes from a pointless diversion to a life-saving necessity. What is "traffic"? In the ham radio world, traffic is a message, and "traffic handling" usually refers to sending, receiving, relaying, and delivering formal written messages via amateur radio.

"Oh, that's easy. I can send messages with my hands tied behind my back. It's too simple. It's boring. It's a total waste of time." Maybe it is—now. But will it always be? What happens when the pressure is on? What happens when you have to jury rig your station just to make a contact? Things that are simple under normal circumstances often become nightmares when the chips are down.

I just bought a new computer, and for the last few days I have been enjoying trying to install all my software. That means digging out all the CDs and loading them onto the hard drive. Of course, however, you can't just load the program. You have to enter the serial number, too. I put the disk for Pagemaker into the drive and started the installation process. Eventually, I got to a screen that required the serial number. No problem. I don't use pirated software, and I keep all the manuals, inserts, and such. Thus, the serial number had to be there, right? It was not. Well, it was only three years ago that I bought this version and loaded it. Where was the $#@% number? I found all sorts of numbers, but not this serial number. Oh, maybe I should have used the number from the earlier version. No problem—I had it on the 3.5 inch disks.

I entered the number, and the program told me that it was invalid. I tried every number I could think of. Nothing worked. Finally, I remembered there is an opening screen of Pagemaker that comes up each time the program boots. Sure enough, the number was there, and it was the same number I first entered. However, this version had two hyphens in it. When I went back and reentered the number with the hyphens in the appropriate spots, the installation program purred like a cat.

*123 NW 13th Street, Suite 313, Boca Raton, FL 33432
e-mail: <wb2d@cq-amateur-radio.com>

THE AMERICAN RADIO RELAY LEAGUE

RADIOGRAM

VIA AMATEUR RADIO

NUMBER	PRECEDENCE	HX	STATION OF ORIGIN	CHECK	PLACE OF ORIGIN	TIME FILED	DATE

TO

TELEPHONE NUMBER

THIS RADIO MESSAGE WAS RECEIVED AT
AMATEUR STATION _____ PHONE _____
NAME _____
STREET ADDRESS _____
CITY, STATE, ZIP _____

REC'D FROM	DATE	TIME	SENT TO	DATE	TIME

THIS MESSAGE WAS HANDLED FREE OF CHARGE BY A LICENSED AMATEUR RADIO OPERATOR WHOSE ADDRESS IS SHOWN IN THE BOX AT RIGHT ABOVE. AS SUCH MESSAGES ARE HANDLED SOLELY FOR THE PLEASURE OF OPERATING, NO COMPENSATION CAN BE ACCEPTED BY A "HAM" OPERATOR. A RETURN MESSAGE MAY BE FILED WITH THE "HAM" DELIVERING THIS MESSAGE TO YOU. FURTHER INFORMATION ON AMATEUR RADIO MAY BE OBTAINED FROM ARRL HEADQUARTERS, 225 MAIN STREET, NEWINGTON, CT 06111

THE AMERICAN RADIO RELAY LEAGUE, INC. IS THE NATIONAL MEMBERSHIP SOCIETY OF LICENSED RADIO AMATEURS AND THE PUBLISHER OF QST MAGAZINE. ONE OF ITS FUNCTIONS IS PROMOTION OF PUBLIC SERVICE COMMUNICATION AMONG AMATEUR OPERATORS. TO THAT END, THE LEAGUE HAS ORGANIZED THE NATIONAL TRAFFIC SYSTEM FOR DAILY NATIONWIDE MESSAGE HANDLING.

PRINTED IN USA

One of two computer-friendly ARRL radiogram forms that can be downloaded as a .PDF file and printed out on your home computer. Note separate spaces for each word in the body, and five spaces per line, to make counting words easier.

The American Radio Relay League
RADIOGRAM
Via Amateur Radio

Number	Precedence	HX	Station of Origin	Check	Place of Origin	Time Filed	Date

To:

This Radio Message was received at:
Amateur Station_____ Date_____
Name_____
Street Address_____
City, State, Zip_____

Telephone Number:

From	Date	Time	To	Date	Time
REC'D			SENT		

A licensed Amateur Radio Operator, whose address is shown above, handled this message free of charge. Handled this message free of charge. As such messages are handled solely for the pleasure of operating, a "Ham" Operator can accept no compensation. A return message may be filed with the "Ham" delivering this message to you. Further information on Amateur Radio may be obtained from ARRL Headquarters, 225, Main Street, Newington, CT 06111.

The American Radio Relay League, Inc. is the National Membership Society of licensed radio amateurs and the publisher of QST Magazine. One of its functions is promotion of public service communication among Amateur Operators. To that end, The League has organized the National Traffic System for daily nationwide message handling.

Another variation of the ARRL radiogram form that can be downloaded as a .PDF file and printed on your computer. While these forms look "official," they are designed more for your convenience in gathering all necessary information and are not required for handling traffic.

The point of all this? I'm a computer user, not a computer tech. Thus, I don't load programs onto hard drives every day. Since I don't do it very often, I may not be very proficient at it. Simple things such as hyphens trip me up, and I waste a couple of hours. If I did it on a regular basis, I would be proficient.

Group One – For Possible "Relief Emergency" Use

ONE	Everyone safe here. Please don't worry.
TWO	Coming home as soon as possible.
THREE	Am in _____ hospital. Receiving excellent care and recovering fine.
FOUR	Only slight property damage here. Do not be concerned about disaster reports.
FIVE	Am moving to new location. Send no further mail or communication. Will inform you of new address when relocated .
SIX	Will contact you as soon as possible.
SEVEN	Please reply by Amateur Radio through the amateur delivering this message. This is a free public service.
EIGHT	Need additional _____ mobile or portable equipment for immediate emergency use.
NINE	Additional _____ radio operators needed to assist with emergency at this location.
TEN	Please contact _____. Advise to standby and provide further emergency information, instructions or assistance.
ELEVEN	Establish Amateur Radio emergency communications with ____ on _____ MHz.
TWELVE	Anxious to hear from you. No word in some time. Please contact me as soon as possible.
THIRTEEN	Medical emergency situation exits here.
FOURTEEN	Situation here becoming critical. Losses and damage from_____ increasing.
FIFTEEN	Please advise your condition and what help is needed.
SIXTEEN	Property damage very severe in this area.
SEVENTEEN	REACT communications services also available. Establish REACT communication with _____ on channel _____.
EIGHTEEN	Please contact me as soon as possible at _____.
NINETEEN	Request health and welfare report on _____ . (State name, address and telephone number.)
TWENTY	Temporarily stranded. Will need some assistance. Please contact me at _____.
TWENTY ONE	Search and Rescue assistance is needed by local authorities here. Advise availability.
TWENTY TWO	Need accurate information on the extent and type of conditions now existing at your location. Please furnish this information and reply without delay.
TWENTY THREE	Report at once the accessibility and best way to reach your location.
TWENTY FOUR	Evacuation of residents from this area urgently needed. Advise plans for help.
TWENTY FIVE	Furnish as soon as possible the weather conditions at your location.
TWENTY SIX	Help and care for evacuation of sick and injured from this location needed at once.

Emergency/priority messages originating from official sources must carry the signature of the originating official.

Group Two – Routine Messages

FORTY SIX	Greetings on your birthday and best wishes for many more to come.
FIFTY	Greetings by Amateur Radio.
FIFTY ONE	Greetings by Amateur Radio. This message is sent as a free public service by ham radio operators at _____. Am having a wonderful time.
FIFTY TWO	Really enjoyed being with you. Looking forward to getting together again.
FIFTY THREE	Received your _____. It's appreciated; many thanks.
FIFTY FOUR	Many thanks for your good wishes.
FIFTY FIVE	Good news is always welcome. Very delighted to hear about yours.
FIFTY SIX	Congratulations on your _____, a most worthy and deserved achievement.
FIFTY SEVEN	Wish we could be together.
FIFTY EIGHT	Have a wonderful time. Let us know when you return.
FIFTY NINE	Congratulations on the new arrival. Hope mother and child are well.
*SIXTY	Wishing you the best of everything on _____.
SIXTY ONE	Wishing you a very Merry Christmas and a Happy New Year.
*SIXTY TWO	Greetings and best wishes to you for a pleasant _____ holiday season.
SIXTY THREE	Victory or defeat, our best wishes are with you. Hope you win.
SIXTY FOUR	Arrived safely at _____.
SIXTY FIVE	Arriving _____ on _____. Please arrange to meet me there.
SIXTY SIX	DX QSLs are on hand for you at the _____ QSL Bureau. Send _____ self-addressed envelopes.
SIXTY SEVEN	Your message number_____ undeliverable because of _____. Please advise.
SIXTY EIGHT	Sorry to hear you are ill. Best wishes for a speedy recovery.
SIXTY NINE	Welcome to the _____. We are glad to have you with us and hope you will enjoy the fun and fellowship of the organization.

** Can be used for all holidays.*

Table I– ARRL numbered radiogram messages.

ASSOCIATED RADIO

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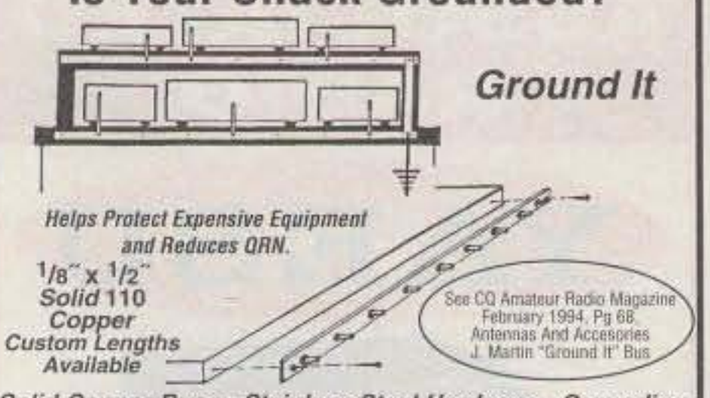

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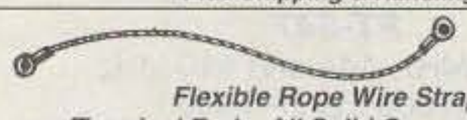

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HXA	(Followed by number) Collect landline delivery authorized by addressee within....miles. (If no number, authorization is unlimited.)
HXB	(Followed by number) Cancel message if not delivered within....hours of filing time; service originating station.
HXC	Report date and time of delivery (TOD) to originating station.
HXD	Report to originating station the identity of station from which received, plus date and time. Report identity of station to which relayed, plus date and time, or if delivered report date, time, and method of delivery.
HXE	Delivering station get reply from addresses, originate message back.
HXF	(Followed by number) Hold delivery until....(date).
HXG	Delivery by mail or landline toll call not required. If toll or other expense involved, cancel message and service originating station.

For further information on traffic handling, consult the Public Service Communications Manual *or the* ARRL Operating Manual, *both published by the ARRL.*

Table II– Handling instructions (optional).

Can you think and perform under pressure? Can you handle details with precision? In short, are you ready to handle traffic in an emergency? In the midst of an emergency there will be pressure—lots of it—and there will be a premium on efficiency. Are you ready to accept messages from the public? Do you know what to say and how to say it? Do you understand National Traffic System (NTS) procedures, precedences, and handling instructions?

First let's look at the structure of a typical message. Regardless of the mode of transmission, all messages have pretty much the same structure. Four main parts comprise the standard message form: the Preamble, Address, Body, and Signature.

We the People...

No, not *that* preamble. The Preamble of an amateur radiogram identifies and summarizes the message (form, not content). Each message begins with a number assigned by the station of origin. Most stations start over with "number 1" at the beginning of each month (or each year, if they don't originate many messages). Only the station of origin assigns a number to a message. Subsequent relay stations simply pass the message along "as is."

Precedence is the next part of the preamble. This is essentially a ranking of importance, with four distinct levels: routine, welfare, priority, and emergency. The first three may be abbreviated on CW and packet (R, W, and P, respectively), but Emergency is always spelled out regardless of mode. Routine is pretty much what it sounds like. "Having a great time at the fair" or "Have you seen the new Spielberg movie?" are pretty obviously routine messages. Of course, we want to deliver them as quickly as possible, but the world will not end if it takes a day or two.

During an emergency very little routine traffic will be handled. It's not a matter of it being against the rules, but in a typical emergency or disaster, traffic with higher ranking will take up most of the message-handling resources. Welfare messages tend to come in two flavors: queries ("are you okay?") and statements ("we survived the storm just fine"). These are of equal importance and can be thought of as roughly equivalent to the Red Cross's Disaster Welfare Inquiry (DWI) message. Considered more important than routine traffic, Welfare messages still take a back seat to priority and emergency messages.

Priority messages often have a specific time limit or are official messages that do not qualify as an emergency message. Press dispatches (within FCC guidelines) and notification of death or injury fall into this category, too.

Finally, emergency messages are those which have life and death urgency to any person or group of persons and which are transmitted via ham radio in the absence of regular communication channels. Examples might include the Red Cross asking for supplies, materials, or instructions vital to the relief of the stricken in emergency areas. The ARRL's advice is "When in doubt, do not use it."

How do you know what precedence to assign to a message? Sometimes it will be pretty obvious, as in the case of typical welfare messages. Certainly, participating in lots of drills and emergency exercises will give you exposure to what others believe about these rankings. However, the only real way to develop a "feel" for it is to handle a lot of traffic.

After the precedence in the preamble comes handling, or HX, instructions. These are optional for the station of origin, but if included, they must be passed along by all relaying stations. The in-

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structions are standardized notes to assist the last ham in the chain to know exactly how the message should be treated. For instance, HXE is a special code that requests that the receiving station get a reply from the addressee and send a message back. On CW and packet the three-letter instructions are simply sent as three letters. On phone the sending station pronounces the H and X and gives the phonetic for the third letter—for example, "HX Echo." A complete list of Handling Instructions is available on the ARRL leaflet "Amateur Message Form."

Next comes the station of origin. It is simply the callsign of the station that first introduces the message into the amateur circuits. The "count" follows. It consists of a numeric total of the number of words in the body of the message. Please note that normal punctuation symbols are not used in the message text and are replaced with "X." X is used between each sentence or fragment. Each "X" is counted as a word. Why have a count? Simple. The count helps ensure that the message is transmitted from one station to the next exactly the way it started. If the receiving station counts 12 words in the message text while the count is sent as 14, he knows that there is a problem and not to acknowledge receipt until he is positive that he has the message copied perfectly.

Finally, the preamble contains place of origin, time filed, and date filed. Suppose you live in Ravenswood, West Virginia, and someone from Ripley, the next town over, calls you on the landline and asks you to send a message to cousin Gert in Iowa. You would list Ripley, WV as the place of origin. Next comes the time of filing (optional) and the date. This completes the preamble, the first major part of the message.

The (Gettysburg?) Address

The Address is next. It is exactly what it sounds like. You should have the same information that the post office would need to deliver a letter, including the ZIP code. A ZIP code is useful in routing the letter to the right area of a state. Also, most NTS traffic is delivered via telephone, so include a phone number (with area code) whenever possible.

After the address comes the text or body of the message. Here less is more. Messages should always be kept brief and to the point. The ARRL has created a list of numbered messages that function much like the Q-signals used on CW. For instance, message number four reads "Only slight property damage here. Do not be concerned about disaster reports." It would be sent in the text part of the message as "ARL FOUR." The letters ARL are always inserted ahead of each numbered message. Thus, you might have a text that is sent as ARL FOUR ARL Six. The ARL FOUR would still translate the same, but a new sentence is added to the message that reads, "Will contact you as soon as possible." Not all the messages deal with difficult situations; as an example, ARL SIXTY ONE reads "Wishing you a very Merry Christmas and a Happy New Year." One other thing to note: You should add the letters "ARL" to the check of all messages that have ARL numbered messages in the text. A typical check for a message with ARL numbered messages in the text might read ARL 8 instead of just plain 8.

Finally, the last major part of the message is the signature. It is the name of the person who originated the message, not the ham who first filed the message. It is always a good idea to include a telephone number for the per-

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son originating the message. This way, if there's a reply, the phone number will be right there. That, in a nut shell, is the structure of a piece of formal amateur radio traffic.

This is all you really need to know about traffic handling to join in on the fun and, at the same time, prepare yourself to be professional and efficient in a real disaster.

Enough theory. You need practice, practice, practice. The best way to get practice is to begin to participate in traffic nets. Most, if not all, of the local nets now meet on VHF repeaters. Most state nets meet on 75/80 meters. Log onto the ARRL web site or pick up a copy of the *ARRL Net Directory*. Listen in on a few sessions, get a feel for how the net flows, and then join in.

Net Structure

One of the things you will notice quickly is that these nets, even the local ones on repeaters, tend to be structured. The Net Control Station (NCS) will call for check-ins with traffic first. Then he/she will call for other stations who wish to check in and take (receive) traffic. In general, stations transmit only when the NCS invites them to.

Here are some other tips that can help you. Traffic nets and silly phonetics (Willy Billy Two Dorko) don't mix. Stick with the standard phonetics. Also, it is considered "liddish" to use Q-signals on phone. Most hams do it a little bit now and then, but you are likely to get called on it on a phone traffic net. Speak distinctly and use plain English.

Sooner or later some traffic will come your way. Just relax and write down the message exactly as you hear it. If you're not sure of something or missed something, ask for a repeat of that section of the text. Make sure that your word count of the message text agrees with the count in the preamble. You can use the "official" ARRL message pads, your own form that you design on your computer, or simply a piece of paper. The ARRL's message pads can be purchased through their store and dealer network. You can also log onto the ARRL web site and download either of two PDF versions for printing locally. Or you could copy it on your word processor if you know your way around a keyboard. Finally, for the ultimate form freak, ARRL even sells postcards designed for those times when you end up mailing the message. No comment on the absurdity of this one.

Traffic handling is fun and great training, but 99% of all the messages you pass will be routine. How can you get practice dealing with messages that are of a higher precedence? Simple. Become involved in your local Amateur Radio Emergency Services (ARES) group. Most ARES groups sponsor practice drills several times each year. These exercises will give you a chance to hone your skills and get some solid practice handling traffic other than routine—even if it is just pretend.

The ARRL has a number of free and inexpensive aids to help you learn traffic handling. The Amateur Message Form is a free card that summarizes the structure of a piece of traffic and covers precedences, handling instructions, Q-signals, and common abbreviations. The ARRL Numbered Radiograms is another free paper that explains how to send and receive numbered radiograms as well as lists each alongside its translation. The *Public Service Communications Manual* explains ARES and other organizations as well as giving a short tutorial on traffic handling. Finally, the *ARRL Operating Manual* has a whole chapter devoted to traffic handling.

Learn to handle traffic now, when there is no pressure. If you become proficient, you will be efficient when you find yourself in the midst of a disaster operation. You will know what to do and how to do it. It will be second nature to you. That's what I call being smart.

Have you checked out the Beginner's Forum on the *CQ* web site yet? (Go to <http://www.cq-amateur-radio.com>, then click on "CQ Forums.") Stop by and browse through some of the topic threads. You'll learn a bit about using mag-mount antennas indoors, what features to look for on new rigs, and more. If you have a question, post it. You'll be surprised at how quickly experts come out of the woodwork to answer your question. Enjoy!

73, Pete, WB2D

Call for Photos and Stories

We'd like to hear from you about your experiences as a newcomer. If you have questions, we'll try to incorporate them into future columns. If you have photos (color prints or slides okay) of your station or antennas, please send them along and we'll publish the best ones. If you have a solution to a common problem that new hams experience, we'd like to hear about it so we can pass it along. You can contact me at <wb2d@cq-amateur-radio.com> or Peter O'Dell, WB2D, Beginner's Corner, 123 NW 13th St., Suite 313, Boca Raton, FL 33432.

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Public Service

BY BOB JOSUWEIT, WA3PZO

Public Service and Emergency Communications

Medical Hams Provide Worldwide Public Service

Each of us has a chosen profession. Some of us go to work every day as electricians, broadcasters, photographers, journalists, or computer specialists. Others make valuable contributions to their community. Many of us take our skills and either apply them to or incorporate them in a hobby we all love—ham radio. This month we take a look at doctors and others with medical interests merging their professions with their hobby.

MARCO—35 Years Strong

A group of dentists and physicians formed the Medical Amateur Radio Council (MARCO) in 1966. MARCO promotes goodwill and fellowship among amateur radio operators worldwide who are professionals in the healing arts, or who have an interest in various medical, dental, and allied fields. Members meet on the air to discuss and exchange medical information. Whenever possible, they are available to assist with medical emergencies and other priority traffic.

MARCO members don't just sit around waiting for the next disaster to occur. The actively search for ways to help out, most often volunteering medical assistance and advice. *CQ* asked MARCO President Bruce Small, KM2L, of Buffalo, New York, "Why join another organization? I already belong to my local club."

Bruce responded, "I do belong to a couple of local radio clubs in western New York. They are a great bunch of guys, and we do have a lot of fun. MARCO is something altogether beyond that, however. I joined MARCO in the mid-1980s, simply because the organization represented the intersection of two of my major interests. What I found was a group of congenial, helpful people on the MARCO nets and I immediately felt welcomed."

MARCO provides medical assistance through its MediShare Program. As the name suggests, the program provides opportunities for members to share their talents, expertise, surplus medical or dental equipment, medicine, and supplies to clinics, hospitals, and dispensaries wherever needed. Both MARCO and Medishare are federally tax-exempt "501(c)(3)" organizations.

Gene Hoenig, M.D., WB3FTJ, and his wife Judy, N3MBW, of suburban Philadelphia are directors of Medishare. Gene explains that Medishare consists of two parts. The first involves equipment and supplies. Members who have any surplus medical equipment, pharmaceuticals, and supplies can offer the material to the program. Nearly all of the equipment can placed. The second part involves personal service opportunities in which health providers serve as short-term replacements for medical personnel going on home or sick leave. There is also a European component of Medishare called The Bush Hospital Foundation.

Providing the Link

Now in its twelfth year, Medishare got its start on the ham bands during a Sunday morning QSO between Ken Kirk-Bayley, GJØKKB, on the Island of Jersey; Kirby Palmer, 9X5KP, in Rwanda; and Dr. Robert Smithwick, W6JZU (now W6CS), of Los Altos Hills, California. According to Hoenig, Kirby explained that he was on the staff of a small jungle hospital in the interior of Rwanda, in East Africa. He said the only sterilizer in the hospital had burned out its gasket and the staff had no way to sterilize instruments for surgery and had to resort to boiling water. Kirby had no more materials on hand to repair the unit, which he had repaired many times over the years. Kirk-Bayley in Europe and Dr. Smithwick immediately set about trying to find a usable gasket or a replacement sterilizer. The sterilizer was a World War II surplus unit and the manufacturer had gone out of business many years ago.

A few days later a Chicago area ham whom Ken had contacted found an exact replacement gasket in its original sealed plastic bag at a hospital in Hinsdale, Illinois. In a follow-up conversation with Kirby a few days later, they were able to tell him that the new gasket was on its way by air. The Mugenero Hospital in Rwanda had its sterilizer back in service. As a follow-up, upon hearing this story MARCO members spontaneously offered other surplus sterilizers, which were then made available to the little hospital.

Ken Kirk-Bayley, GJØKKB, visits with a friend in Africa. (MARCO/Medishare photos courtesy of Medishare International and the Bush Hospital Foundation)

Land Rovers such as this one have been donated to third world countries by Medishare and the Bush Hospital Foundation.

Medishare began to work with several non-profit humanitarian agencies across the U.S. that have long-established, successful programs for providing medical supplies and equipment to

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e-mail: <wa3pzo@cq-amateur-radio.com>

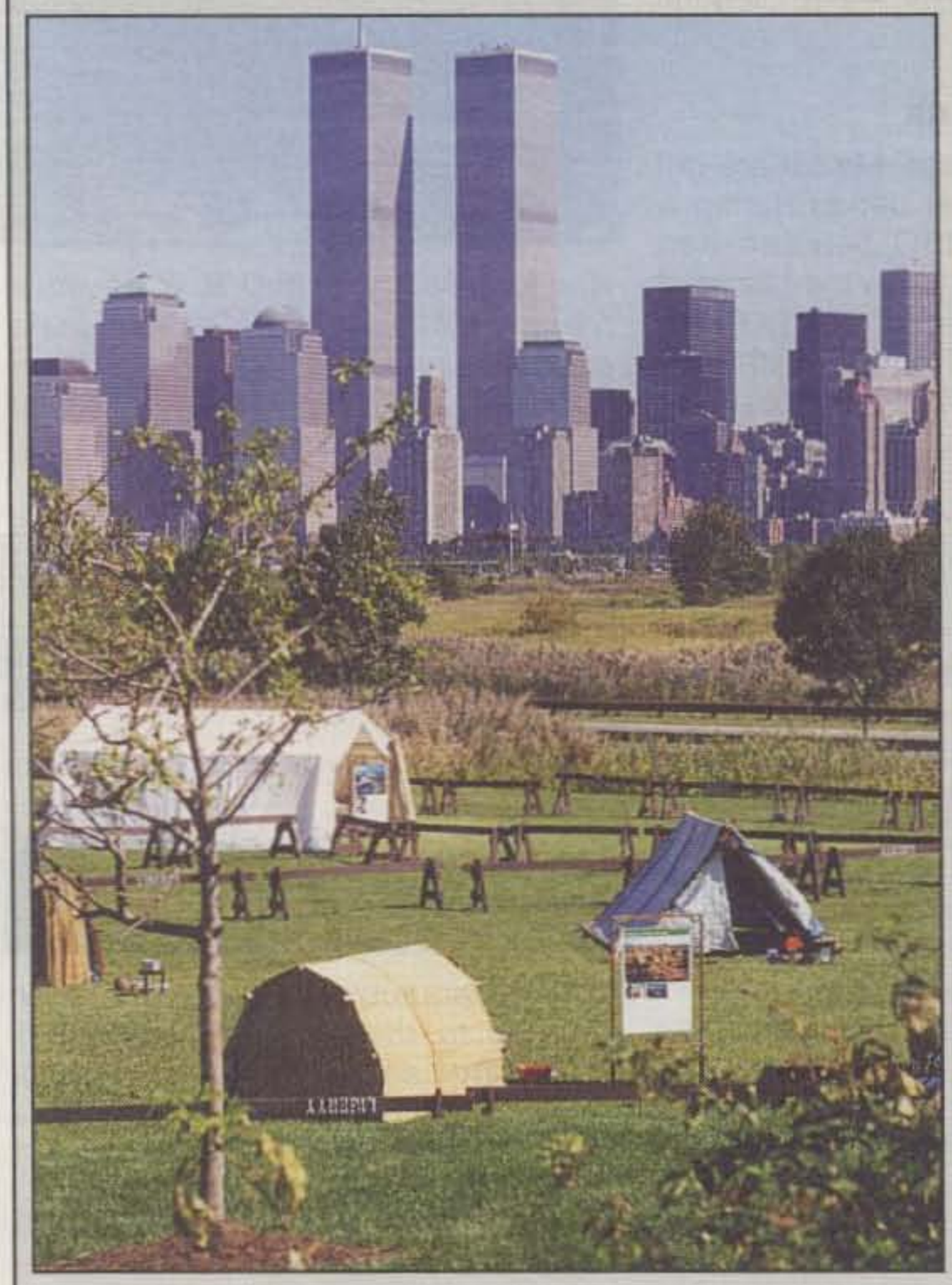
A Refugee Camp in New Jersey?

"Imagine a war breaks out in your hometown," says the sign at the entrance to a makeshift refugee camp within view of the Statue of Liberty and the skyscrapers of New York City. This "refugee camp in the heart of New Jersey" on the grounds of the Liberty Science Center was not built to house people trying to escape bloodshed in their home countries. Organized and staffed by Doctors Without Borders (also known in French as Medecins Sans Frontieres), which won the Nobel Peace Prize in 1999 for its work with refugees in 80 different countries, the camp was built to bring home to Americans the daily struggles faced by some 39,000,000 refugees and "internally displaced persons" (refugees who find shelter within their own countries) around the world.

Many radio amateurs are involved with this organization, including some of the doctors and other specialists, so I went to see if I could find anyone there who could talk to me about the role that amateur radio plays in the group's work. I was immediately impressed by the fact that our "tour guides" spoke from first-hand knowledge.

Luke, who led our small group tour, is originally from Liberia and spent several months in a refugee camp in Africa — as a refugee — before coming to the United States and becoming a volunteer for Doctors Without Borders. He showed us different types of tents used in refugee camps in different parts of the world, and explained how people in the camps slept, ate, and got by on 5-6 gallons of water per day (the average American, says DWB, uses 70-140 gallons per day!).

Home Sweet Home? If you've been driven out of your real home and are lucky enough to make your way to a UN refugee camp, a tent such as this one, plus basic cooking equipment and five gallons of water a day, may become your temporary home. There are different types of temporary dwellings for different climates.



With the towering buildings of New York City providing an incongruous backdrop, "A Refugee Camp in the Heart of New Jersey" was designed to provide comfortable Americans with a glimpse of life in refugee camps around the world. ("Refugee Camp" photos by W2VU)

Besnik Doli, a Doctors Without Borders volunteer, was a radio operator while living in a refugee camp in Kosovo. "Without those radios," he said, "it would have been almost impossible to manage in the camps."

After a while, I broke off from the tour and went looking for someone who could talk to me about radio. I found Besnik Doli, an accountant from Kosovo, who started working with Doctors Without Borders during the three months he spent living in a refugee camp in Kukes, Albania. He started out by helping in the office, where his accounting skills were needed, and then by filling in as radio operator when the post became vacant. "My callsign — I will always remember it — was Sierra Foxtrot 46."

Doli wasn't familiar with amateur radio as such, but when I showed him a copy of August *CQ*, containing an update on ham radio activity in Kosovo, he immediately recognized the photos, knowing where they were taken without reading the captions. But his eye was caught by an advertisement for SGC's SG-2020 mini-HF transceiver. "That was our radio!" he exclaimed. "Yes, that's exactly what we used."

He explained that the United Nations High Command for Refugees provided Motorola handhelds for local communications and satellite phones for international calls, as well as the HF radios for communications between the camps and to UN headquarters in Tirana, 125 miles away.

"We used (the handhelds) to talk with different experts who were out in the field," Doli explained. "They were very useful. Without the radios, it would have been almost impossible to have contact with the experts in the field."

The HF radios, he added, were also used for connections to towns to send messages to families. "Without those radios," Doli concluded, "it would have been almost impossible to manage in the camps."

For more information on Doctors Without Borders, visit the organization's website at <http://www.doctorswithoutborders.org>.

— *W2VU*

Hazmat Feedback

Our December article on hams helping with hazardous materials incidents prompted many comments. Many requested additional information on programs mentioned in the column. Still, a couple expressed concern about hams working in areas for which they are not trained. Don Davis, W1DWA, a retired Industrial Fire Chief, says he has "never even considered using unqualified civilian assistance…No amateur should be responding to anything he or she is not completely trained and authorized to do." He continues, "The last thing I ever wanted when commanding an incident was some civilian, albeit with good intentions, reporting to my Command Post to offer help."

A hazardous-material incident could involve a large tire fire, a nuclear power plant accident, or a terrorist incident. From experience, I have been assigned by emergency management officials to a staging area at a large tire fire to help provide a common frequency for many responding agencies. The command post was well upwind and was not in any danger. I also served as ARRL Section Emergency Coordinator during the Three Mile Island nuclear accident, where I was asked to pass radiological information. Hams are routinely asked to do this during drills today. The key is having a basic understanding of the terminology so that you can pass information more accurately. If you are in a leadership role, you can more effectively communicate with your counterparts in emergency management by knowing the terminology. As Jerry Boyd, K6BZ, a retired police chief, said in last month's column, "amateur radio operators may need to meet certain training requirements or their services will no longer be called upon."

qualified recipient medical facilities. These organizations also have trained medical technicians and laboratories, shops, and facilities for the repair and testing of donated equipment. The Adventist Relief Agency and the Radiological Equipment Assistance Program (REAP) were two of the original organizations anxious to assist MARCO with its developing Medishare program. REAP was founded in 1973 by Jim Sharpe, W6LNF.

Let's now take a look at two success stories.

Zambia

A few years ago a large shipping container filled with medical equipment, instruments, and drugs was shipped to two remote, rural hospitals in Zambia. Hoenig explained the equipment established a modest but very serviceable surgical and general anesthetic facility. This particular project was a unique nine-way partnership among Rotary clubs in the United States and in Zambia, the Rotary International Foundation, MediShare International, the Bush Hospital Foundation, Direct Relief International of Santa Barbara, California, and the U.S. government.

The Santa Maria Rural Health Centre is located on Chilubi Island in the vast Bangweulu Lake in northwestern Zambia. It is a 78-bed hospital serving an estimated population of 53,000, plus an additional 29,000 outpatients, through the use of a Land Rover mobile clinic/ambulance recently provided by Bush Hospital Foundation–MediShare International. St. Fidelis Mission Hospital, near Kasama, is a 70-bed hospital serving a population estimated at 43,000.

Until recently, neither hospital had ever had a surgery unit. This meant that doctors were often unwilling to practice there due to the lack of such basic facilities. If a doctor was not available, medical treatment was provided generally by nurses. Patients requiring surgery and anesthesia had to be referred to another hospital. If the Santa Maria Rural Health Centre had to refer patients to another hospital, they had to be transported across the lake in an open outboard motorboat. This was a four to eight hour trip (weather permitting) plus several more hours driving over primitive dirt roads which were sometimes washed out.

The original SMHC (hospital) boat sank in a storm in February 1999. The Bush Hospital Foundation–MediShare acquired a replacement boat with twin forty-horsepower engine, in the summer of 1999. It was upgraded and modified in Europe prior to being shipped to the hospital on Chilubi Island. In addition to providing transportation, it also serves as a marine ambulance.

In appreciation for the donations by all of the groups involved, Sr. Annie Chanda, the Sister in Charge, said, "I'm assuring you that your generous offer has really solved a lot of problems at our health facility. We are very much ready to open up an operating theatre and improve our service delivery to a large number of our needy people. You have actually contributed a lot to the improvement of the quality of life and restoration of human dignity of the people of Zambia at large."

Malawi

Malawi isn't a name, or a place, that is in the news every day. It is the fourth

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Bringing Communication to Education Since 1980

A relief agency volunteer inspects some of the medical equipment donated by MARCO and Medishare members.

Judy Hoenig, N3MBW, keeps in contact with Medishare members around the world.

poorest country in the world, a landlocked nation in Central Africa with a huge population. The Bush Foundation's Dr. Mike Marks spent some time in Malawi meeting with health officials and with the deeply concerned staff of Malawi University and Medical School in Blantyre.

They described for him a unique problem. The country has one of the world's highest incidences of HIV/AIDS. Females are actively discriminated against in third-world education systems, and as a result, young teenage girls in particular have a very high level of illiteracy. They simply couldn't read the educational materials being provided. Trained health workers visited villages and communities in person to hold classes and sponsor discussions on AIDS prevention and maternal and child health. They traveled between villages by bicycle. Given the large geographic area to be covered on a daily basis, and the inaccessibility of many villages to even bicycles, a 4-wheel drive vehicle was donated by MediShare at a cost of about $8000. The vehicle enables project workers to reach 2000 girls a year in the surrounding villages. It also doubles as a hospital ambulance. The University of Malawi staff and students developed and provided the educational materials. Medicine, including children's vitamins and IV solutions, and an array of medical equipment, instruments, and other supplies were obtained for $4975. The estimated value of the shipment, based on US wholesale prices, was $75,361.05, said Hoenig. The Bush Hospital Foundation, contributing approximately $30,000, planned, built, equipped, and supported the "new" consolidated OB/Gyn unit in the hospital.

Medishare had a unique opportunity to assist the Montfort Hospital in Malawi because there was room in the shipping containers for a substantial quantity of medical equipment and supplies. The shipping costs, which did not increase, were paid for by the Bush Foundation. The consignee for both hospitals was Professor Robin Broadhead, Dean of Medicine, with whom Medishare and the BHF have worked before.

Broadhead wrote, "I wish to thank you most sincerely for the generous donation of Direct Relief to Montfort Hospital. The consignment of medicines and equipment arrived safely at the end of last month. After customs clearance it was unpacked with much celebration. Some of medicines could be immediately used. We are very grateful to you and to all those who contributed to this generous donation. I can assure you that it will be carefully used and is not taken for granted. Montfort Hospital serves a poor area where most people earn their living by subsistence farming. Thus your donation is targeted to those in much need."

Medishare members are currently studying the Bush Hospital Foundation to see if a similar organization could be set up in this country. Medishare derives its contributions via yearly dues. It is hoped that Medishare would be able to operate off interest rather than donations. In order to do this, MediShare would need substantial initial capital.

Smithwick, who received the 1996 ARRL International Humanitarian Award, wrote, " . . . the genuine satisfaction has come from knowing that this modest program, participated in by literally scores of you fellow ham-members of MARCO, many other 'hams,' and hundreds of interested people, has been

This guest house was considered a "five star" hotel in Africa.

able to assist some of the most needy, most deserving, and yes, some of the most appreciative people on this earth."

Small, the current MARCO president, encourages anyone connected with a medical profession or interest to get involved with MARCO and Medishare. "MARCO members have taught me a great deal about medicine, about radio communications, about organizational management, and about friendship," he said. "I have also had the opportunity to teach and serve them. Although I was a 'Net Newbie' in 1995, my limited experience put me ahead of most of MARCO's membership. Then-President Polycard Gadegbeku, WB4LPC (now KZ4P), appointed me to head the effort to put MARCO on the internet. Setting up our mailing list and website was an opportunity to learn a great deal, have fun, and provide something of value to the group. That felt so good that I haven't stopped!

"MediShare, of course, is an exciting program that makes a real difference to disadvantaged people who struggle daily just to survive. It's just a wonderful feeling to support the well-organized and very effective efforts being made by MediShare and our partner agencies," said Small.

Continuing Education

Each Sunday MARCO hosts "Grand Rounds" on the air (10 AM Eastern Time, 14.308 MHz). "It is literally the high point of my week," said Small. The Grand Rounds provide an opportunity to discuss items of interest to the medical community. At times continuing educational units are offered. "It is emceed alternately by Bob Currier, WB5D, a retired professor of Neurology at the University of Mississippi, and by Warren Brown, KD4GUA, a general practitioner in Tampa," said Small. "The medical topics they discuss are timely, the conversation is lively, and the participants never fail to have a good time and learn something."

This month we want to thank Gene and Judy Hoenig, Bruce Small, MARCO, and Medishare for providing information. For further information on MARCO and Medishare check out their websites: <http://www.smbs.buffalo. edu/med/marco/index2.html> and <http://www.medishare.org>, respectively. We look forward to hearing how your group is serving in the public interest. Until next month . . .

73, Bob, WA3PZO

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Amateur Television

BY ED MANUEL, N5EM

All About Ham TV

Finishing the ATV Repeater—Plus a Look at the ICOM R3 Receiver

In the October 2000 ATV column I presented some information on building a simple ATV repeater. A few details remain to be discussed this month.

Antennas are, of course, a function of two issues—the selection of bands and the desired pattern and gain. Consider my small, local ATV repeater. I needed to receive the 915 MHz signal from a camcorder. This dictated a non-directional, vertically polarized antenna.

For simplicity, I chose a homemade quarter-wave vertical. Since this vertical antenna is for signals generally under the plane of the ground plane, I chose to mount it upside down. For my link to the repeater, I needed an antenna for 1255 MHz that could provide some gain to provide a good, saturated signal.

I selected a homemade Yagi from an article by Kent Britain, WA5VJB, published in *CQ VHF* magazine. We have built many of these Yagis in Houston over the last few years and know them to be repeatable and reliable. Also, since they are made from lightweight materials, they fit the requirements for mounting atop my light poles. As mentioned last time, I chose to feed them with RG-8X coaxial cable as a compromise between low loss and low weight.

Photo 1– Typical packaged power packs. You just can't have enough power.

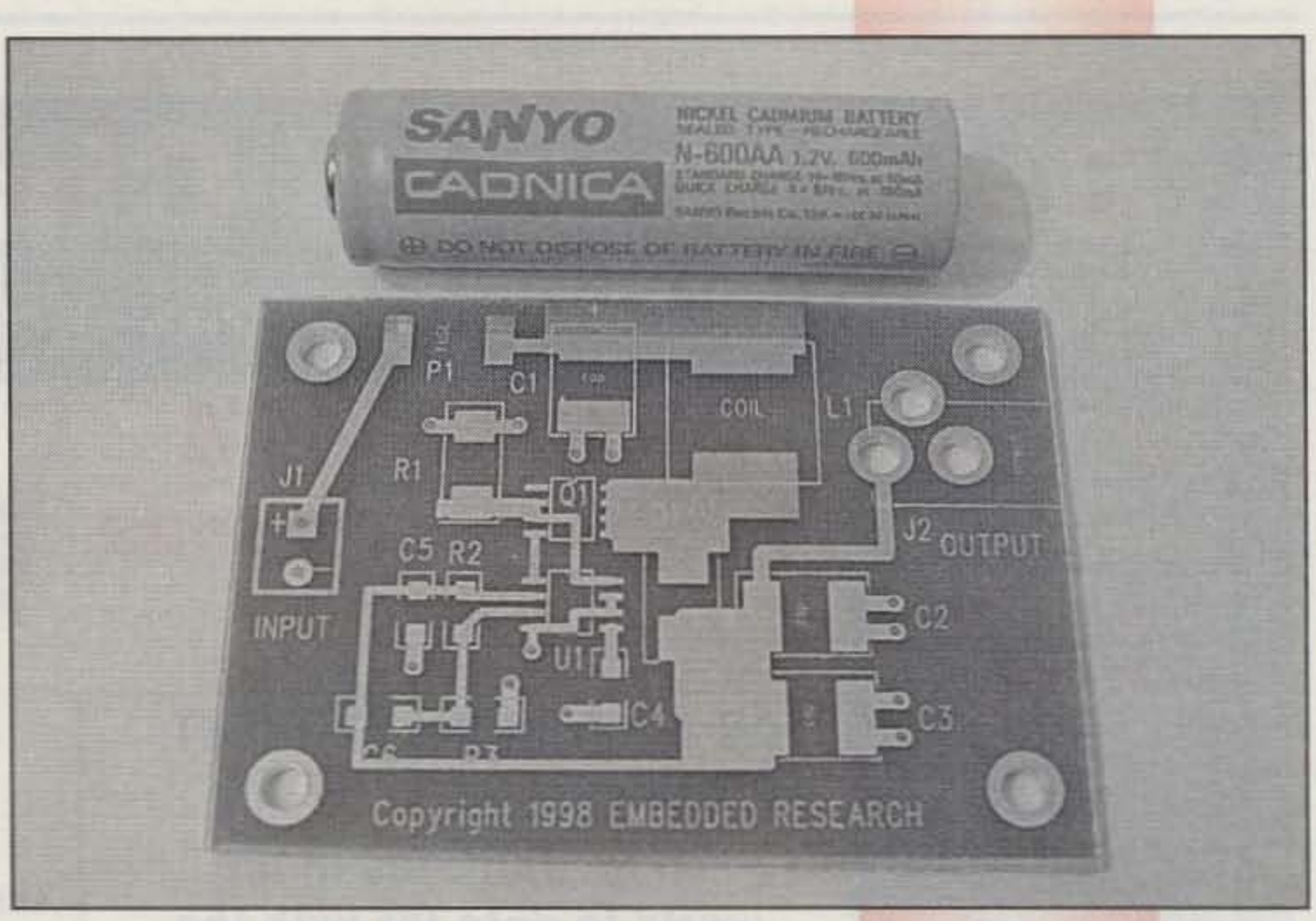

Photo 2— Tiny circuit board for the EPS-1 The AA battery is for size comparison. (See text for details.)

Power Sources

Next is the subject of power. For this repeater the primary source of power is a battery. I have several of the packaged gel-cell battery systems so readily available today (photo 1). One of these contains a 12 VDC, 4 amp-hour battery. The other two each contain a 7 amp-hour battery. These are suitable for intermittent operation for a couple of hours with my low-power transmitter. For use with my 2 watt transmitter they are a little marginal. I also have an auto battery in a marine plastic case for use when longer operation is planned. The choice of battery system is solely a function of your current consumption and your planned operation. If you are using more transmitter power, you will need larger batteries.

There is no substitute for actual operation to highlight weak areas in the system. You might be able to characterize the power consumption and duty cycle of your system and estimate correctly the exact power system you will require, but I doubt it. Things simply just don't go as planned. Most amateurs estimate what they need, then take two for back-up. At a function such as a public-service event where others are watching your operation and using your services, you don't want to be explaining that your battery ran down. Another thing to watch for is degraded performance before the system actually quits operation. We found this out last year at the

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Photo 3– The ICOM R3 video display set to alpha-numeric display on 915 MHz.

Photo 4– The R3 equipped with log periodic antenna for 900–2500 MHz.

Houston Marathon. Some of our transmitters continued to work but began to degrade in picture quality as the battery voltage began to sag. Operation *appeared* to be okay locally, but other stations that had receive capability began to notice the problems.

I'm trying something new this year as a result of that experience. I will be using a boost-type power regulator. This little circuit takes any voltage from 2 to 16 volts and supplies a regulated 12 VDC at up to 0.5 amps. This is perfect for my transmitter. This will ensure that the transmitter sees constant voltage until the actual battery end-of-life. Of course, there is no free lunch. Assuming that you need the half amp to run your transmitter, you will require a total of 6 watts (12 volts×0.5 amps). If your battery system is supplying 12 volts, you are drawing slightly more (allowing for the efficiency of the converter). If your battery drops to 10 volts, you now require 0.6 amps. At 8 volts you will be drawing 0.75 amps. Do you hear that sucking sound coming from your battery? What we are getting here is a stable operating voltage until we abruptly lose the battery supply. This little power converter is available from Embedded Research. You can find more information on their website at <http://www.frontiernet.net/~embres>. The product I am using is their model EPS-1 (photo 2).

Finally, I need to discuss some other items that your portable repeater may need. I chose to use two FM frequencies for my system. Since the receiver is reasonably close to the camera-mounted units, no filtering is required. Also, since I'm using an FM transmitter back to the main repeater site, I don't require any special filtering. If you are using AM transmitters, you very well may require vestigial side-band filters to make operation acceptable in your area. If you don't know whether this might apply to you, you probably should seek some assistance. Certainly in high-RF areas such as southern California, you will need to consider other users and the need for additional filtering. Again, ATV operation is not consistent from place to place, and local practices dictate different approaches. Make sure you are in concert with what is going on in your area. Generally, this means notifying your local frequency coordinator of your plans far enough ahead of any event to allow for any modifications necessary to prevent or minimize interference to other band users.

That's it for now on the portable ATV repeater. There are many ways to approach this subject, and this is only one person's version. I hope it has gotten your creative juices flowing and opened up the possibilities for you.

A Scanner for the ATVer!

Since the lead time for a column such as this is so long, lots can happen from one column's deadline to the next. I had been waiting for the ICOM R3 handheld receiver to appear for quite some time, since its somewhat premature announcement last year. Well, the R3 is finally here. I got mine back in September and have had a blast with it (photo 3).

Consider that this is a conventional scanner with an LCD TV screen on the front. It covers from 100 kHz to 2450 MHz. Yes, that's right, 2.45 GHz! You get all the conventional stuff you would expect with a scanner—AM, FM, FM-wide—so you can listen to all that stuff scanner buffs like to listen to (cellular blocked, of course), *plus* it can receive not only AM television, but also FM tele-

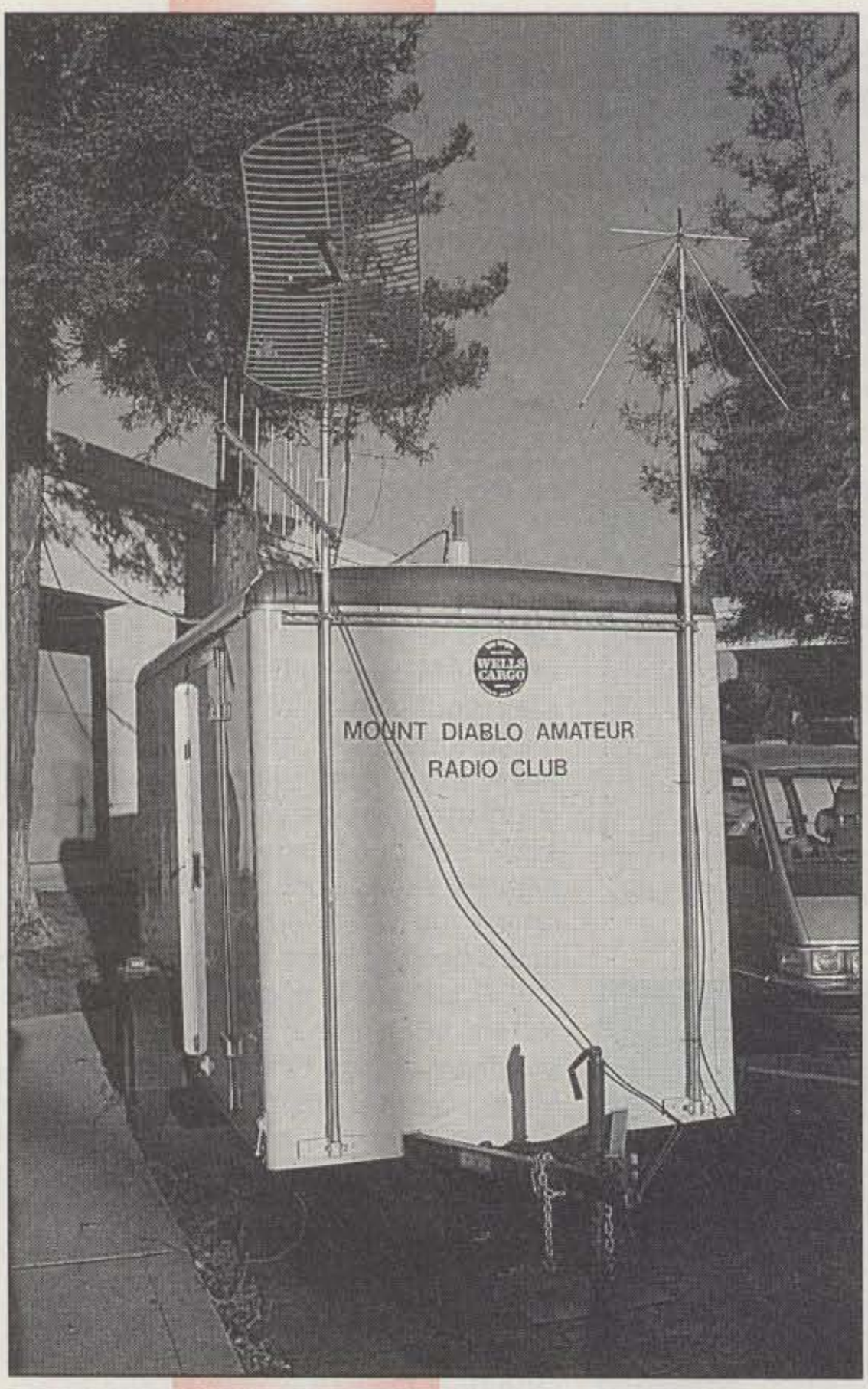

Photo 5– The Mt. Diablo Amateur Radio Club ATV trailer. Antennas include (left to right) 70 cm Yagi, 2.4 GHz dish, and discone for broadband use.

vision. As an AM television receiver it is capable of any frequency from 30 MHz through 2450 MHz. As an FM television receiver it covers 900–1300 MHz and 2250–2450 MHz. While that omits some commercial FM television frequencies that might be interesting, it sure covers the ham bands. Here is a pocket-size ATV receiver that covers *every ATV frequency* in our 70 cm, 33 cm, 23 cm, and 13 cm bands. Wow! (See photo 4.)

One aspect of traveling as a ham is being able to hook up with local hams when you are in a new place. Most of us carry an FM handheld for this purpose. A few travel with ATV gear to try to connect. However, the vast differences in local ATV makes this a challenge. Now with one small receiver you can be assured that you can receive any ATV frequency you will encounter. Nothing is perfect, though. You still need to be in a place where you have adequate signal, and you might need to carry some type of external antenna to be able to pull in that ATV signal you want. The reception technology is a done deal, though, as they say.

I had the occasion to attend this year's Pacificon in Concord, California. I went out to see the Mt. Diablo Amateur

"One aspect of traveling as a ham is being able to hook up with local hams when you are in a new place. Most of us carry an FM handheld for this purpose."

Radio Club ATV van in the parking lot (more on that in a bit). A fellow ATV enthusiast was in the trailer playing with his new R3 and having a little trouble (it's not particularly intuitive to operate). Since I had had one for a while, I volunteered to help. Within minutes we had the R3 looking at the Mt. Diablo ATV repeater on 70 cm AM television. (Those mountains are really great. I sure wish we had one in Houston.) I could see the mountaintop miles away from the parking lot. There was no problem receiving the ATV repeater! Next I asked about the 2.4 GHz antenna on the trailer. That was being used as a link. I tuned that one in on the R3 and handed it back to its owner. Needless to say, he was very pleased with his new radio.

The R3 is not perfect, of course. The internal lithium-ion battery provides about two hours of operation with the LCD display on. That display is a real power hog and drains the battery in a hurry. If you have the need to use the R3 as a continuous television monitor receiver for an extended period of time, you will need an external power supply. Additionally, the AC power supply (wall-wart) that comes with the R3 is suitable for operating the R3 with the display off or for recharging the battery. It does not supply sufficient current to operate the R3 with the display on. One might also consider the $500 price a disadvantage.

I do not intend this to be a comprehensive review of the R3, but the unit has such applicability to amateur television I could not avoid bringing it to the attention of the ATV community. In my book, it's the second coolest new radio of 2000, and the other one has nothing to do with ATV.

ATV Mobile Unit Envy

As I mentioned before, I had the good fortune to be able to attend Pacificon in Concord, California. The Mt. Diablo Amateur Radio Club sponsors this ham convention. The ATV trailer is a great place to do public-service events (photo 5). The trailer is equipped with a telescoping antenna tower for when additional height is needed. Inside there is plenty of room for several people to man different operating positions as the needs of a particular event require.

For Pacificon, the MDARC ATV group was relaying video from inside the convention forum sessions through the production facilities of the trailer and subsequently to the MDARC ATV repeater on Mt. Diablo. The trailer boasts video editing and titling capabilities. I had thought that the right way to create a mobile facility was in a van similar to the facilities employed by radio and television stations today. After seeing this trailer for myself, I am now convinced that this is a much more practical arrangement. While some clubs may have the money to create and maintain a motorized van, many more clubs would be able to afford an arrangement like this. Congratulations to MDARC ATV on its fine vehicle.

One thing I enjoy about traveling to different ham conventions is seeing what other groups have done and bringing back ideas that might be useful for my club. You can bet we will be discussing such a project in Houston.

73, Ed, N5EM

Washington Readout

BY FREDERICK O. MAIA, W5YI

Regulatory News In The World Of Amateur Radio

Getting the Callsign of Your Choice

The "Ground Rules" of the FCC's Vanity Callsign Program

In our last column we presented the history of the FCC's "vanity" callsign program. From 1978 until May 31, 1996 radio amateurs were not allowed to choose their station callsigns. The FCC had abolished "vanity" station callsigns in 1978 primarily due to abuse by certain amateurs and FCC staffers who were issued preferred callsigns for which they were not qualified.

The most recent vanity callsign program has been in effect now for nearly five years, yet the application procedure remains a mystery to most amateurs. This month we will tell you how to go about getting the amateur station callsign of your choice. There is more to it than you think!

Only Individuals and Club Trustees Eligible

There are four basic types of amateur radio station licenses, but only two are eligible to apply for a vanity callsign. Primary station licenses are granted to individuals. Even though only three license classes are now issued, all six license operator classes (i.e., Novice, Technician, Tech Plus, General, Advanced, and Amateur Extra) are eligible to apply for a vanity callsign.

On March 25, 1995, after a nearly 20 year lapse, the FCC again began granting new ham club and military recreation station licenses. Amateur radio clubs may apply for a special callsign, but the trustee's operator class determines the callsign format eligibility (more on this later).

Military recreation station licenses are granted to persons who have been appointed by a military official to be the license custodian of an amateur station located at a military recreational site. Radio Amateur Civil Emergency Service (RACES) station licenses were granted to persons appointed by a governmental agency to be the custodian of a station providing civil defense communications during a local, regional, or national civil emergency.

Neither Military Rec nor RACES station custodians are required to be licensed radio amateurs and neither is eligible to apply for a vanity callsign. RACES station licenses are being phased out. None have been issued since March 24, 1978, and (effective April 15, 2000) none may be renewed.

Vanity Callsign System Policies

The vanity callsign program was initially phased in by the opening of various starting "gates." Each gate extended the ability to request a callsign to additional radio amateurs. The first gate opened on May 31, 1996; the fourth and final gate extended vanity callsigns to the Technician, Tech Plus, and Novice classes on December 2, 1997.

An important feature of the Vanity Callsign System is that licensees must first hold a sequentially-issued callsign which is later traded in for a chosen callsign. Only amateurs who meet certain statutory requirements may request a callsign, and (with a few exceptions) a vanity callsign may only be requested from your (or a lower) callsign "group."

Eligible station licensees or license trustees may submit a list of up to 25 choices in order of preference. The first available callsign is then selected and assigned by the FCC. There are two ways to submit your application. Your request may be filed electronically online or you may use the new FCC Form 605 document and its accompanying Schedule "D." These forms are available from the FCC's internet website at <http://www.fcc.gov/wtb/amateur>.

FCC Form 605 and Schedule "D" are also available from the FCC's fax-on- demand system by calling 202-418- 0177 from the handset of a facsimile machine, or from the FCC's forms contractor by calling 800-418-FORM (3676). This form is *not* the same as the NCVEC Form 605 used by the VE testing program.

Your application package and the proper fee (in a sealed envelope) must show this mailing address: Federal Communications Commission, Wireless Bureau Applications, P.O. Box 358130, Pittsburgh, PA 15251-5130. If your application package is delivered by hand or courier, it must be prepared as described and sealed in a second, outer envelope showing this courier address: Federal Communications Commission, c/o Mellon Bank, 525 William Penn Way, 27th Floor, Room 153-2713, Pittsburgh, PA 15259, Attn: Wholesale Lockbox Shift Supervisor. Do not use the courier address as a mailing address and vice-versa.

You must hold an unexpired amateur operator/primary station license grant of the proper operator class, as described below, to request a vanity callsign for your primary station. To request a vanity callsign for a club station, you must also hold an unexpired club station license grant listing you as the license trustee. Your name and mailing address as shown on your current license must be correct, too.

The fee for a vanity callsign is reviewed annually as part of the Commission's regulatory fee structure. Last September the FCC agreed to retain the same (1999) $14 fee amount through 2001. Payment is accepted by check (payable to "FCC"), bank draft, money order, or credit card. *Do not send cash.*

To facilitate the processing of requests for vanity callsigns each work day, electronically filed forms for which the $14 filing fee has been received are processed first, followed by the paper document Forms 605 and Schedule "D". It thus is to your advantage to file electronically!

Before we go into choosing a vanity callsign, let's go over which callsigns are *not* available to the vanity callsign program under any circumstances. The following groups of callsigns are not available for assignment as vanity calls:

•KA2AA–KA9ZZ, KC4AAA– KC4AAF, KC4USA–KC4USZ, KG4AA–KG4ZZ, KC6AA–KC6ZZ, KL9KAA–KL9KHZ, and KX6AA–KX6ZZ. These callsigns are specifically reserved for various groups and geographic areas;

• To eliminate confusion on the airwaves, the suffix letters SOS and QRA– QUZ are not issued;

• Any callsign having the letters AM– AZ as the prefix. Only the AA to AL prefixes are allocated to the United States by the International Telecommunications Union (ITU). AM to AZ

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e-mail: <w5yi@cq-amateur-radio.com>

are allocated to various foreign countries;

• Any 2-by-3 format callsign having the letter X as the first letter of the suffix. These go to experimental (non-amateur) stations;

• Any 2-by-3 format callsign having the letters AF, KF, NF, or WF as the prefix and the letters EMA as the suffix. These are allocated by the FCC to FEMA, the Federal Emergency Management Agency, for disaster communications use.

• Any 2-by-3 format callsign having the letters NA–NZ as the prefix. The NA–NZ prefix with three suffix letters is not currently used by the U.S. Amateur Service.

• Any 2-by-1, 2-by-2, or 2-by-3 format callsign having the letters KP, NP, or WP as the prefix and the numeral 0, 6, 7, 8, or 9. These numerals after the KP, NP, and WP prefix are reserved for (but not currently used in) the Caribbean area.

• Callsigns having the single letter prefix (K, N, or W), any single digit numeral, and a single letter suffix. 1-by-1 callsigns are reserved for the special event callsign system.

As we said before, the requestor may list up to 25 callsigns in order of preference. The exact prefix, numeral, and suffix must be given for each callsign. Requests stated in general terms such as "Any callsign with my initials" or any callsign just having a specific prefix or suffix will not be honored.

The first available callsign on the list for which the requestor is eligible will be shown on the license grant for the requestor's station and the original callsign will be abandoned. The FCC does not entertain objections to the assignment of requested callsigns.

Availability of the Call You Want

If your amateur radio license has expired, or if your name or address has changed, you must first renew your license or request a modification to show the correct information by filing FCC Form 605 with the Commission. Perhaps the easiest way to accomplish this, however, is to pay the $6.00 filing fee and log onto <http://www.qrz.com> or <http://www.w5yi.org> and make the address change online.

At press time, the FCC was in the process of assigning Club Callsign Coordinators to electronically file new club callsign requests. Until this happens, club station requests or trustee modifications must be completed by filing FCC Form 610-B.

Be sure to refer to one of the online licensee databases to verify that the callsign you are requesting is not already assigned. We suggest checking either the license information posted to <http://www.qrz.com> or to the FCC's website at <http://www.fcc.gov/wtb/ uls>. (Click on the "License Search" button, then "Continue," enter your desired callsign, and click on "Search" at the bottom of the screen.)

If you are applying for the callsign of a former holder now deceased, you must be certain that this callsign is not still listed in the FCC Amateur Service database. If it is, you must request that this callsign be deleted from the licensee database prior to your vanity callsign request. This is accomplished by submitting a signed request for license grant cancellation accompanied by a copy of an obituary that shows the date of death, or death certificate, to the FCC, 1270 Fairfield Road, Gettysburg, PA 17325-7245 prior to filing the application for a vanity callsign.

Even where a callsign does not appear on the database, it still may not be available for assignment. For more info on the assignment status of callsigns, contact the FCC's copy contractor, International Transcription Services at 717-337-1433). A callsign is normally assignable two years following license expiration, surrender, revocation, set-aside, cancellation, void ab initio, or death of the grantee. Where a vanity callsign for which the most recent recipient was ineligible is surrendered, canceled, revoked, or voided, the two-year requirement does not apply. For explanations of Groups A, B, C, and D and the geographic Regions, see Fact Sheet PR5000 Number 206-S, Amateur Station Sequential Callsign System.

There are three ways by which an individual and ham clubs may request a vanity callsign. They are (1) request-by-list, (2) former holder, and (3) the close relative or club member of a deceased former holder. You do not need to send the FCC supporting documentation when you request a callsign under the former holder, or deceased relative or club member provisions. However, you must have it your possession if the FCC requests a verification.

Request by List (Primary or Club Station)

Here are the rules by which an individual or club may request a vanity callsign.

• Provide a list of up to 25 callsigns in the order of your preference. The first assignable callsign on your list will be assigned to your station. The callsign must have been unassigned for at least two years.

• If you are an Amateur Extra Class operator, each callsign must be in Group A, B, C, or D. (Group A callsigns have a 1-by-2, 2-by-1, or 2-by-2 AA to AL callsign format. Group B has a 2-by-2 format, except for those noted above. Group C has a 1-by-3 format and Group D a 2-by-3 format.)

• If you are an Advanced Class operator, each callsign must be in Group B, C, or D.

• If you are a General, Technician Plus, or Technician Class operator, each callsign must be in Group C or D.

• If you are a Novice Class operator, each callsign must be in Group D.

Each vanity callsign requested must have a format as follows (refer to FCC Fact Sheet PR5000 Number 206S for additional mailing address requirements):

• Licensees with mailing addresses in one of the contiguous (lower) 48 states may select any Region numeral Ø to 9. (They are not required to select only the numeral designated for their Region.) Within the constraints of their callsign group, the prefix may be AA–AG, AI– AK, K, N, W, KA–KG, KI–KK, KM–KZ, WA–WG, WI–WO, WQ–WZ (but not AH, AL, KH, KL, KP, NH, NL, NP, WH, WL, or WP, which are reserved for licensees with mailing addresses outside of the continental U.S.).

• Alaska mailing addresses: Any Region numeral Ø to 9 and any prefix available to lower 48 states—plus ALØ–9, KLØ–9, NLØ–9, or WLØ–9, which are reserved for Alaska mailing addresses.

• American Samoa mailing addresses: Any Region numeral Ø to 9 and any prefix available to lower 48 states— plus AH8, KH8, NH8, or WH8.

• Commonwealth of Northern Mariana Islands mailing addresses: Any Region numeral Ø to 9 and any prefix available to lower 48 states—plus AHØ, KHØ, NH, or WHØ.

• Guam mailing addresses: Any Region numeral Ø to 9 and any prefix available to lower 48 states—plus AH2, KH2, NH2, or WH2.

• Hawaii mailing addresses: Any Region numeral Ø to 9 and any prefix available to lower 48 states—plus AH6–7, KH6–7, NH6–7, or WH6–7.

• Puerto Rico mailing addresses: Any Region numeral Ø to 9 and any prefix available to lower 48 states—plus KP3– 4, NP3–4, or WP3–4.

• Virgin Islands mailing addresses: Any Region numeral Ø to 9 and any prefix available to lower 48 states—plus KP2, NP2, or WP2.

While individual amateur radio licensees may only hold one station callsign, there is no limit to the number of club station license grants that can be held by the same club. Also, each club station license grant is eligible for a vanity callsign. *(A few people have abused this privilege and the FCC has revoked additional club callsigns; the FCC does not look kindly on multiple club vanity calls without legitimate clubs associated with them. If you file for multiple club vanity calls, expect to get a letter from the FCC's Enforcement Bureau requesting documentation to show that each is a legitimate club.—ed.)*

Request by Former Holder (Primary Station)

For your primary station you may request a callsign that was previously assigned to your primary, secondary, repeater, auxiliary link, control, or space station. When so requesting for your primary station:

• You may request your former callsign even though it has been unassigned for less than two years. The two-year requirement does not apply to an otherwise eligible primary station if the callsign was previously assigned to a station of the requestor.

• You do not have to hold a class of operator license required for the Group (A, B, C, or D) for the callsign requested. A callsign request by a former holder may be from any Group in the sequential system.

• Your mailing address does not have to be in the Region designated in the sequential system for the callsign requested. A callsign requested by a former holder may be in any Region.

Request by Close Relative of Former Holder Now Deceased (Primary Station)

For your primary station you may request a callsign that was previously assigned to the primary, secondary, repeater, auxiliary link, control, or space station of your now-deceased spouse, child, grandchild, stepchild, parent, grandparent, stepparent, brother, sister, stepbrother, stepsister, aunt, uncle, niece, nephew, or in-law. When so requesting for your primary station:

• You may request the former callsign of a close relative now deceased even though it has been unassigned for less than two years. Upon the death of the holder, a callsign is assignable immediately to an otherwise eligible primary station of a close relative.

• You must be an Amateur Extra class operator to request a Group A callsign.

• You must be an Amateur Extra or Advanced Class operator to request a Group B callsign.

• You must be an Amateur Extra, Advanced, General, Technician Plus, or Technician class operator to request a Group C callsign.

• You must be an Amateur Extra, Advanced, General, Technician Plus, Technician, or Novice class operator to request a Group D callsign.

• Your mailing address does not have to be in a Region designated in the sequential system for the callsign requested. A callsign requested by a close relative of former holder now deceased may be in any Region.

• You must show your relationship to the deceased person

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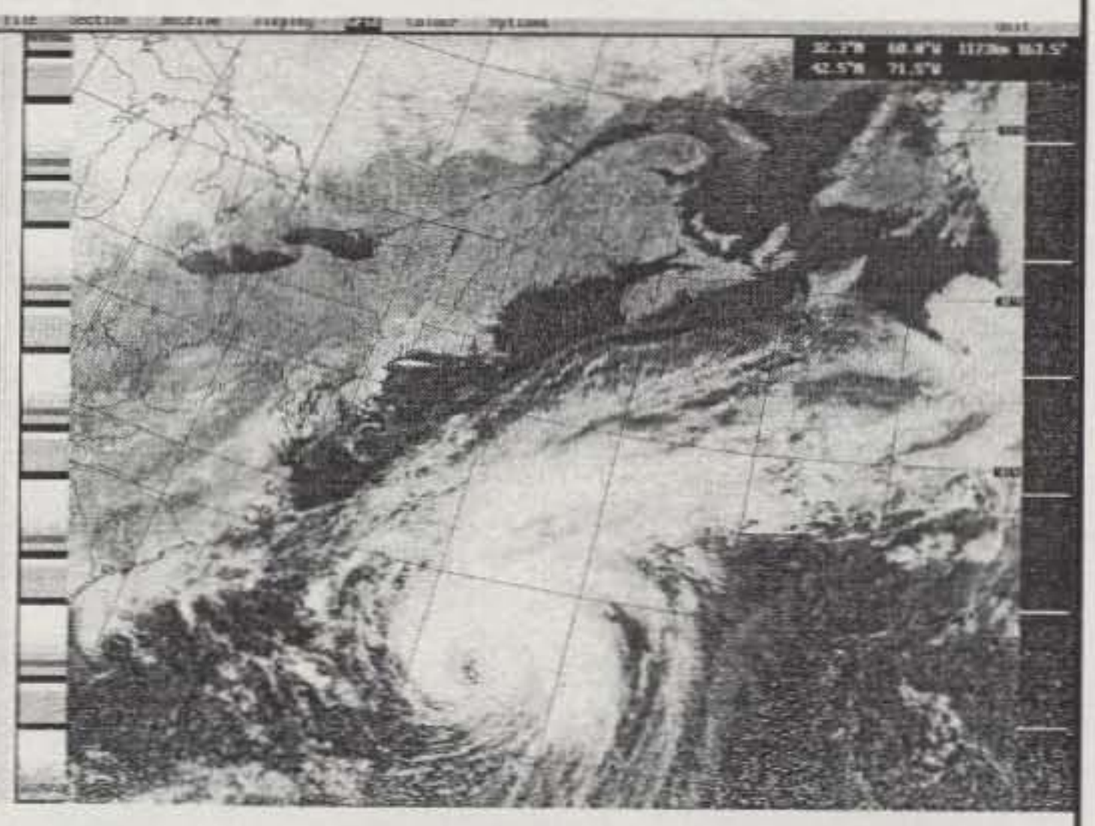

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exactly as listed in the instruction— i.e., "child," "niece," or "in-law."

Request by Former Holder (Club Station)

For the club station for which you are the license trustee you may request a callsign that was previously assigned to that station. When so requesting for a club station:

• You may request your club station's former callsign even though it has been unassigned for less than two years. The two-year requirement does not apply to an otherwise eligible club station if the callsign was previously assigned to the club station for which the requestor is the license trustee.

• You do not have to hold a class of operator license required for the Group (A, B, C, or D) for the callsign requested. A callsign request by former holder may be from any Group in the sequential system.

• Your mailing address does not have to be in the callsign Region designated in the sequential system for the callsign requested. A callsign requested by a former holder may be in any Region.

Request in Memoriam (Club Station)

If you are the license trustee for your club station, you may request for your club station the callsign previously shown on the primary, secondary, repeater, auxiliary link, control, or space station license of a deceased person who was a member of the club. When so requesting a memorial callsign for your club station:

• You may request the callsign even though it has been less than two years following the death of the club member. Upon the death of the holder, the callsign is assignable immediately to an otherwise eligible club station.

• You must have in your station records a written statement (do not send to FCC unless requested) from a spouse, child, grandchild, stepchild, parent, grandparent, stepparent, brother, sister, stepbrother, stepsister, aunt, uncle, niece, nephew, or in-law of the deceased confirming the deceased person's association with the club and showing consent of the relative to your request.

• You must follow the license class/callsign group rules outlined above.

• Your mailing address does not have to be in the Region designated in the sequential system for the callsign requested. A callsign requested in memoriam may be in any Region.

• You must enter the relationship to the deceased person giving consent exactly as listed in the instructions—i.e., "child," "niece," or "in-law."

Finding Information on the Vanity Callsign Program

The FCC's web site at <http://www.fcc.gov/wtb/amateur> has information on electronic filing of vanity callsigns. You should also be familiar with the callsign groups and regions of the sequential callsign system described in Amateur Station Callsign Systems. This announcement is available at <http://www.fcc.gov/wtb/amateur/amateur.html>. For general information, contact the FCC's National Call Center at 1-888-225-5322 (CALLFCC). The FCC also has a Vanity Callsign FAQ (Frequently Asked Questions) web page at <http://www.fcc.gov/wtb/amateur/vnityfaq.html> which covers a lot of the commonly asked questions.

If you are interested in researching the availability of a specific callsign, you might want to check the <http://www.carroll-usa.com/vanity/> website operated by Michael Carroll, N4MC. This site bills itself as the "Amateur Vanity Callsign Headquarters," and they do indeed have a lot of information on the subject. They maintain lists of unused preferential callsigns that are not active, canceled, expired, and not listed in the FCC's database. These callsigns are listed two ways. The first list shows those which have been inactive for more than two years and are available for immediate vanity issue. The second list shows specific callsigns that are in the two-year waiting period and the date they will become available.

The American Radio Relay League also has an excellent online write-up on the Vanity Callsign program at <http://www.arrl.org/arrlvec/vanity.html>. To file online, you must use the FCC's Universal Licensing System (ULS). The first time you use the system you must complete two steps: registering and filing. Subsequent use of the system can be done without re-registering. The ARRL provides a good step-by-step procedure to assist you when you register. Be aware that you must use a recent version of the Netscape browser to register; the Microsoft Internet Explorer browser will not work .

The FCC indicates that the following versions of Netscape Communicator have been tested and are presently compatible with ULS: 4.7, 4.61, 4.51, and 4.5. You can download Netscape Communicator from the Netscape Website. Your computer must use a 32-bit operating system such as Windows 95, Windows 98, or Windows NT. If you plan to pay your $14 fee online using a credit card, you must use the 128-bit encryption version of Netscape.

If all of these rules have you confused, the W5YI Group offers a vanity callsign filing service for a small fee. They will do all the application and filing work for you. Call 1-800-669-9594 if you are interested in having them handle it.

73, Fred, W5YI

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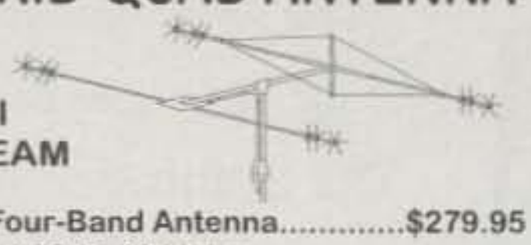

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A Look At The World Around Us

Like CW? The Key is the Key!

Bored with winter? Snowed in? Frozen stiff? Fret not, ham radio friends. Right now is your perfect opportunity to enjoy some premium on-the-air time with a neat rig and a smooth-handling key, bug, or paddle. Say CW does not overly excite your senses? Maybe that is because you need a special key (or two or three!) to spark your interest. We all know even mundane activities such as driving to/from work are more enjoyable in a snazzy sports car than a plain four-door sedan. Doesn't similar logic hold true for keys? You bet it does!

Remember the enthusiasm and exhilaration you felt getting on the air with a brand-new transceiver (or even a rebuilt-to-new classic rig) in the past? You can feel that same rush of excitement using a unique key, and the cost of such "new kid on the block" fun is much more affordable. Anyone can talk, but as Karen Stultz, AD4UI says, CW is a matter of mind over mouth!

Your continued enthusiasm for these "keys special" columns is both admirable and appreciated. Remember, however, we cannot do it without your input. Keep that information and photos coming. Be sure your pictures are in sharp focus, and we will continue to spotlight you and your keys.

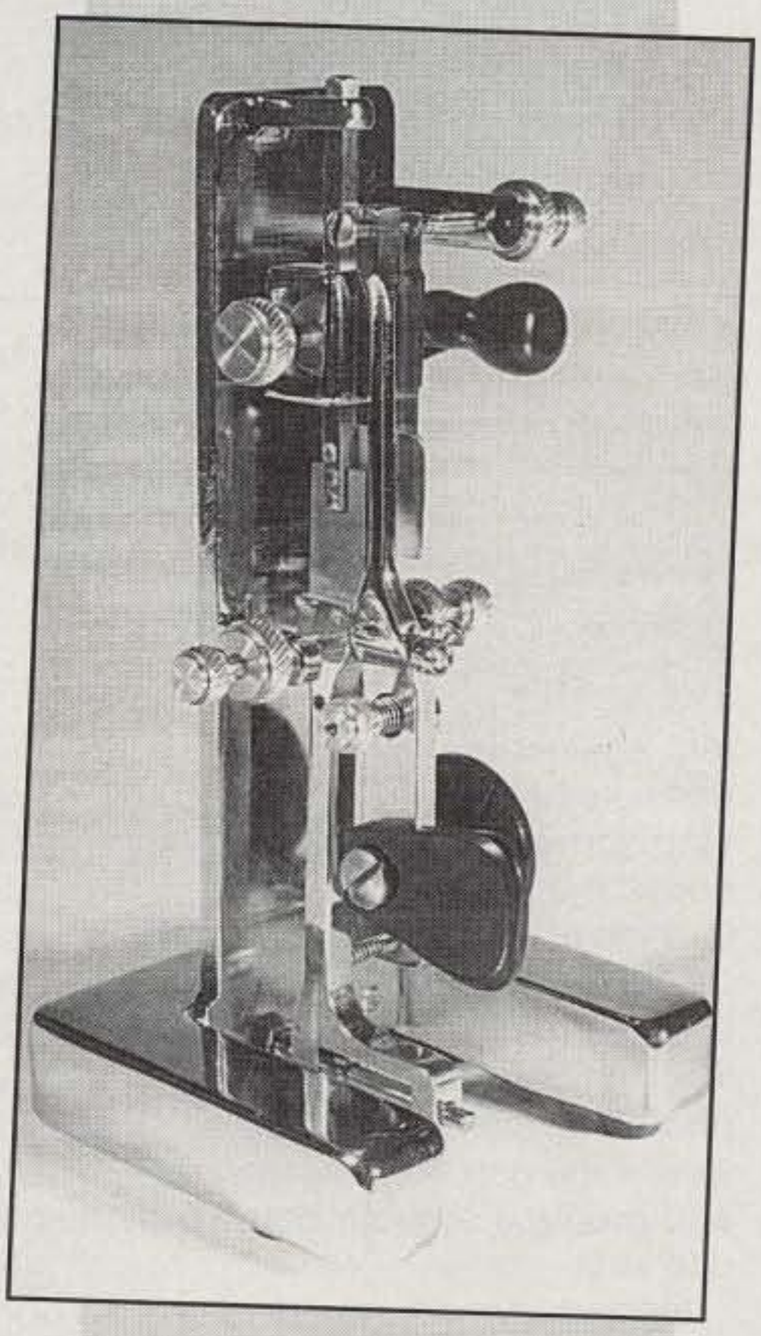
Several readers have asked us to feature more detailed photos and descriptions of special keys, so starting this month we are attempting to honor those requests. I say "attempting," because sometimes it is possible and sometimes a highlighted key is so rare and prized it is kept under strict lock and key and only one photograph is available. Now let's fast forward to the "keyvues"!

Bugs of Unusual Design

If we could cite only one reason why keys continue to be so popular, it surely would relate to their captivating styles and designs. Indeed, each key, bug, and/or paddle has its own special traits and "personality" that make it unique. Two good examples of that fact are the famous Vertical Bug, or "Wirechief's Key," and the "X Model Vibroplex," both of which employ a single set of contacts for making both dots and dashes. Studying such keys in detail by pictures rather than touch is difficult, but refer to photos 1 and 2, and we will give it a try.

4941 Scenic View Drive, Birmingham, AL 35210
e-mail: <k4twj@cq-amateur-radio.com>

Photo 1– One of the most intriguing keys of all times is the upright, or vertical, bug. This little gem uses a single set of contacts to make both dots and dashes. Mechanism pivots from the bottom to produce dots and pivots at the middle to make dashes. →



Notice the bug's contacts and related adjustment screw are near the top right side. Also notice the bug's flexible mainspring and its attached pendulum with speed-adjusting weight are positioned behind or beneath a brass arm with fingerpieces at its lower end and an adjustment screw at its upper end. When the fingerpieces are moved toward the right, the lower pendulum and upper arm pivot together on the small rod you see extending right below my thumb in photo 2 (between the base's shiny end tips). Travel of the full mechanism is then limited by the right and left gap adjusting screws (directly in front and below my index finger in photo 2). The vibrating pendulum causes its attached contact to tap against the top right screw's end contact and produce a series of dots. Photo 2 was taken after vibrations/dots stopped and the moving contact rested against the adjustment screw's contact.

When the bug's fingerpieces are moved toward the left to make dashes, only the brass arm above the vibrating pendulum moves. In this case, an adjustable screw threaded through the brass arm's upper end (the section that looks like the flat blade of a screwdriver in photo 2) presses the moving con-

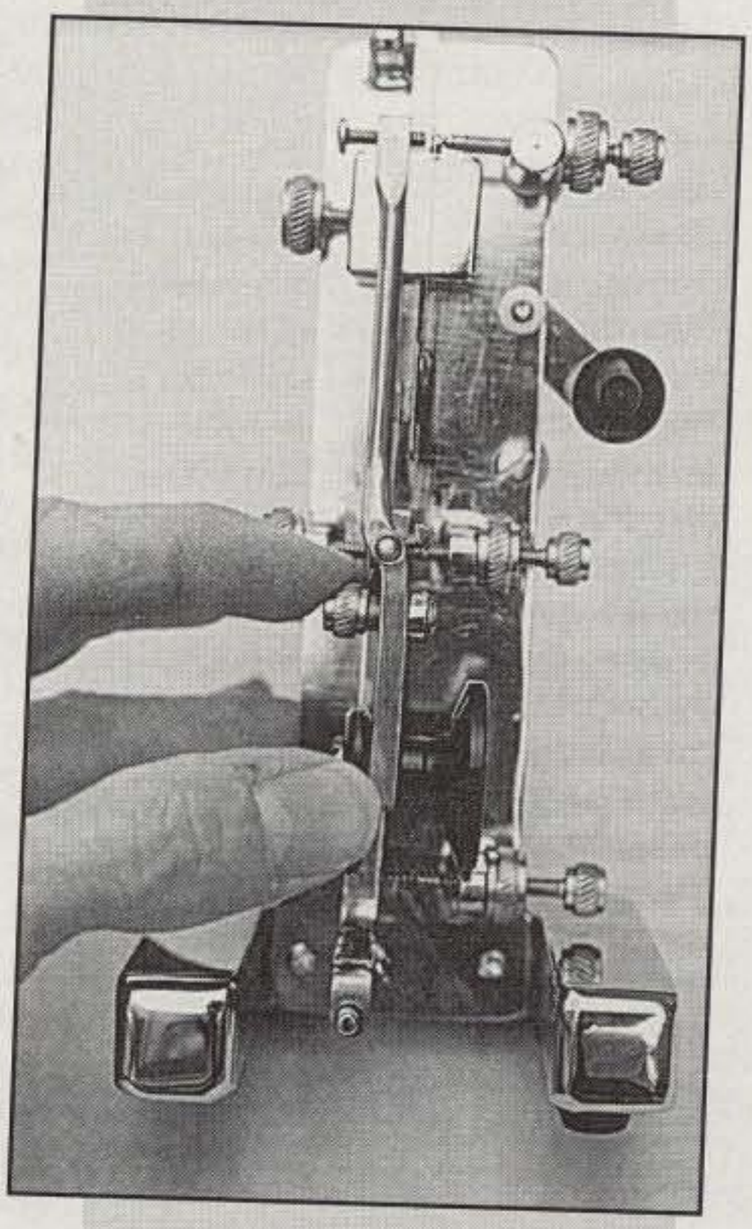


Photo 2– Straight-on view of Vertical bug. My index fingertip is pointing to the brass arm's pivot point. Use a magnifier and you will see the key's contacts are closed and the gap between the "dash pressing screw" and the vibrating contact as described in the text. →

Photo 3– This D & K "Dinger" bug makes dots by releasing pawl-applied hold-back pressure on its center-weighted leaf spring. When the spring vibrates, contacts to the right of weights produce dots. This concept of releasing rather than applying pendulum pressure is opposite to a regular bug's operation.

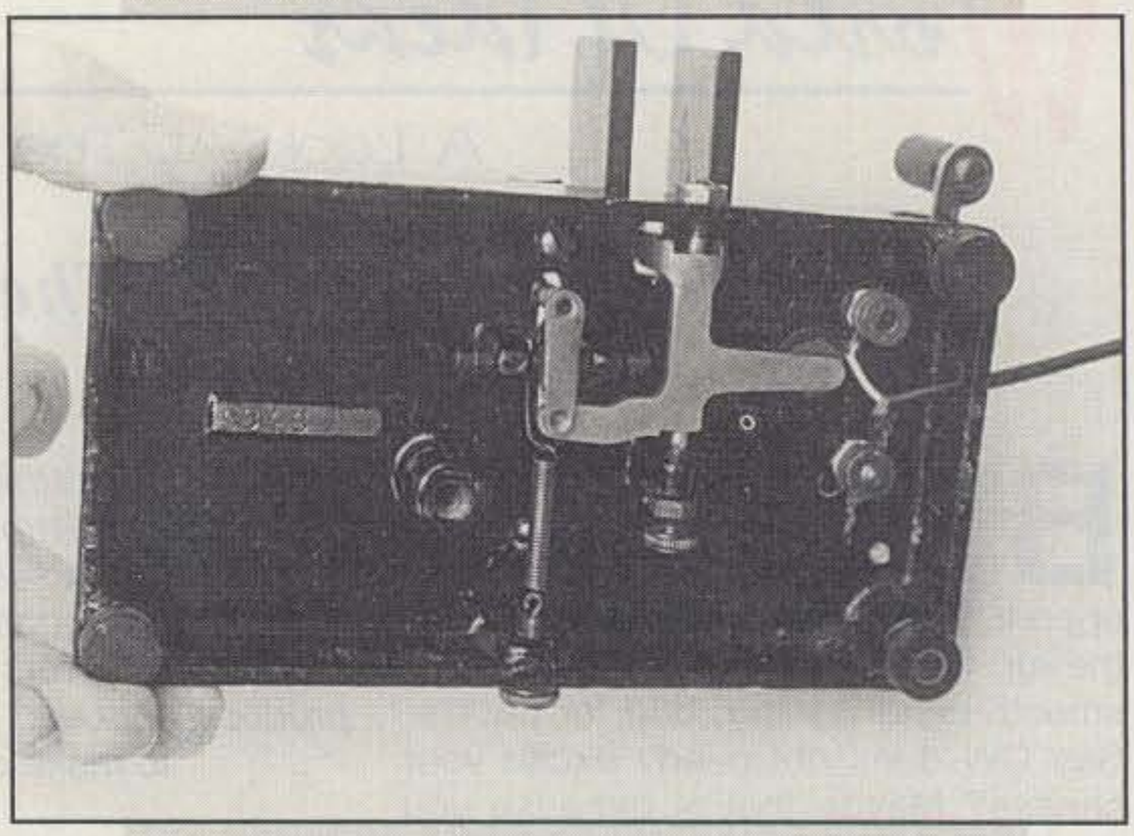


Photo 4– At first glance the D & K "Dinger" appears to have separately operating fingerpieces like a dual -lever or iambic bug. When we flip the key over to study its dot contacts as discussed in the text, however, we see the two fingerpieces are actually part of the bug's single flat arm.

tact against the fixed contact to make dashes. How is that possible? Notice the full mechanism will rest against the left stop screw behind/below my index finger in photo 2. Also notice the shiny silver dot right at the tip of my fingernail. It is a pivot rod that reverses the brass arm's direction of travel. That is why/ how the top screw pushes the flexible contact to the right when the fingerpiece moves toward the left. Notice the gap between the screw and the contact in photo 2. If the gap is adjusted too wide, dash travel is extensive; if the gap is too narrow, the contact cannot move freely and produce smooth dots. Truly this is one far-out, fun-to-use key!

Next up is another wild and wacky bug with real telegraphic pizzazz—the 1920s-style D & K "Dinger" shown in photo 3 and 4. This key's concept of operation is the reverse of a regular bug, probably because D & K was trying to beat Vibroplex patents. When the fingerpiece on a Vibroplex is moved to the right, *pressure applied to the pendulum* causes it to vibrate and produce dots. When the fingerpiece on a Dinger is moved to the right, *it releases or relieves pressure on the pendulum* so it can vibrate and produce dots.

Use your pocket magnifier to study photo 3. Notice two round brass weights positioned right in the bug's middle area. They are mounted on each side of a long, black leaf spring. The leaf spring's left end is attached to a spiral spring which in turn is attached to a "pull tight string" wound around speed- and weight-adjusting screws on the bug's left side. Now look to the right of the round brass weights and you will see the dot contacts, one on the main leaf spring and the other on a shorter leaf . . . err, strip. As long as we are in never-never land, I should also mention that knurled screw with locknut near the key's right middle area sets dash travel and the knurled screw beside the left fingerpiece limits dot arm travel.

Now study photos 3 and photo 4 while visualizing the following concept of operation. When the fingerpiece is moved toward the right to make dots, a flat right-angled arm under the bug's base releases pressure on a top-mounted pawl holding the weights up steady against a rear stop. When that pressure is released, the weighted leaf spring vibrates, causing the contacts on the weight's right side to make and break and produce dots. Look closely at photo 3

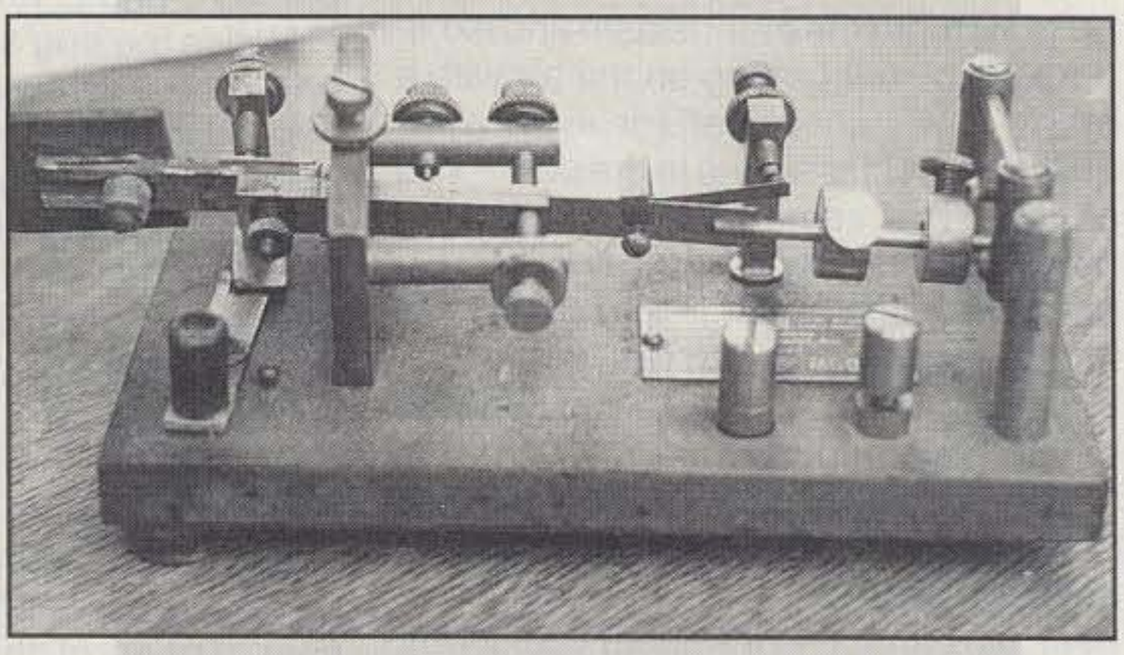


Photo 5– The little lost Dow that Gary Reiss, WAØJRM, rebuilt to new while investigating its history of production in Brewer, Maine.

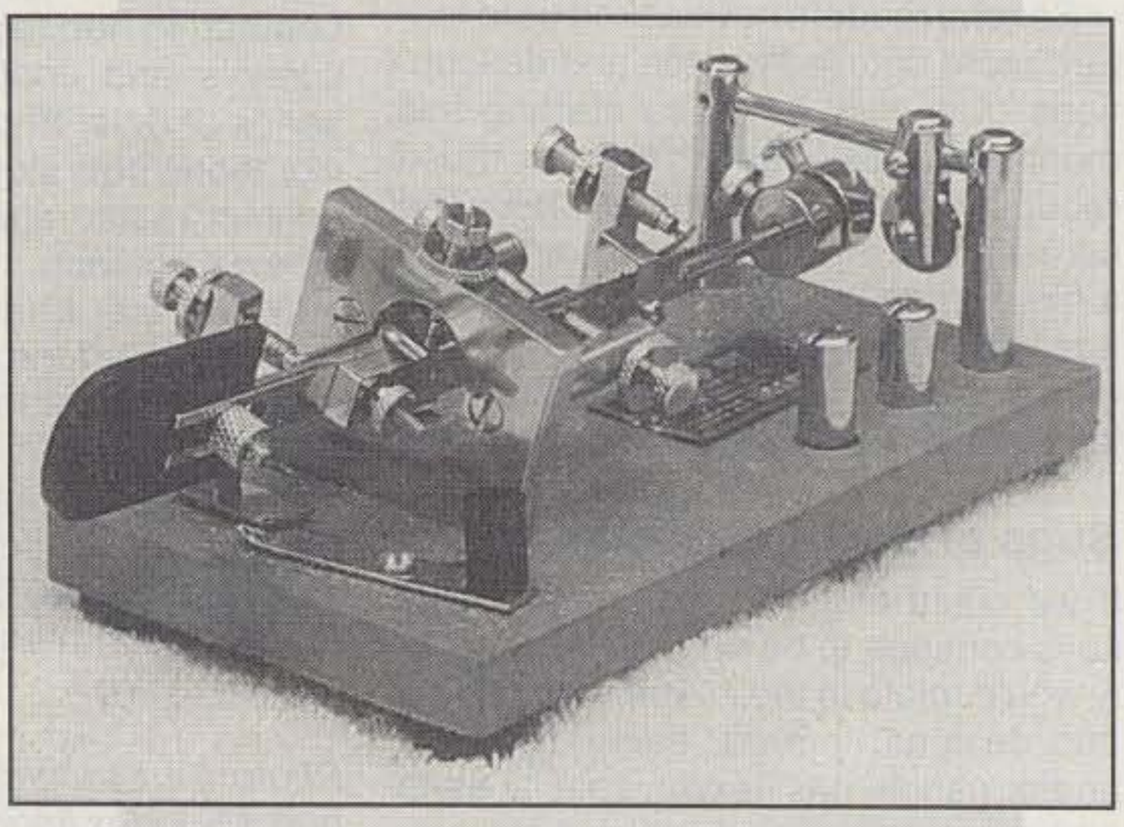
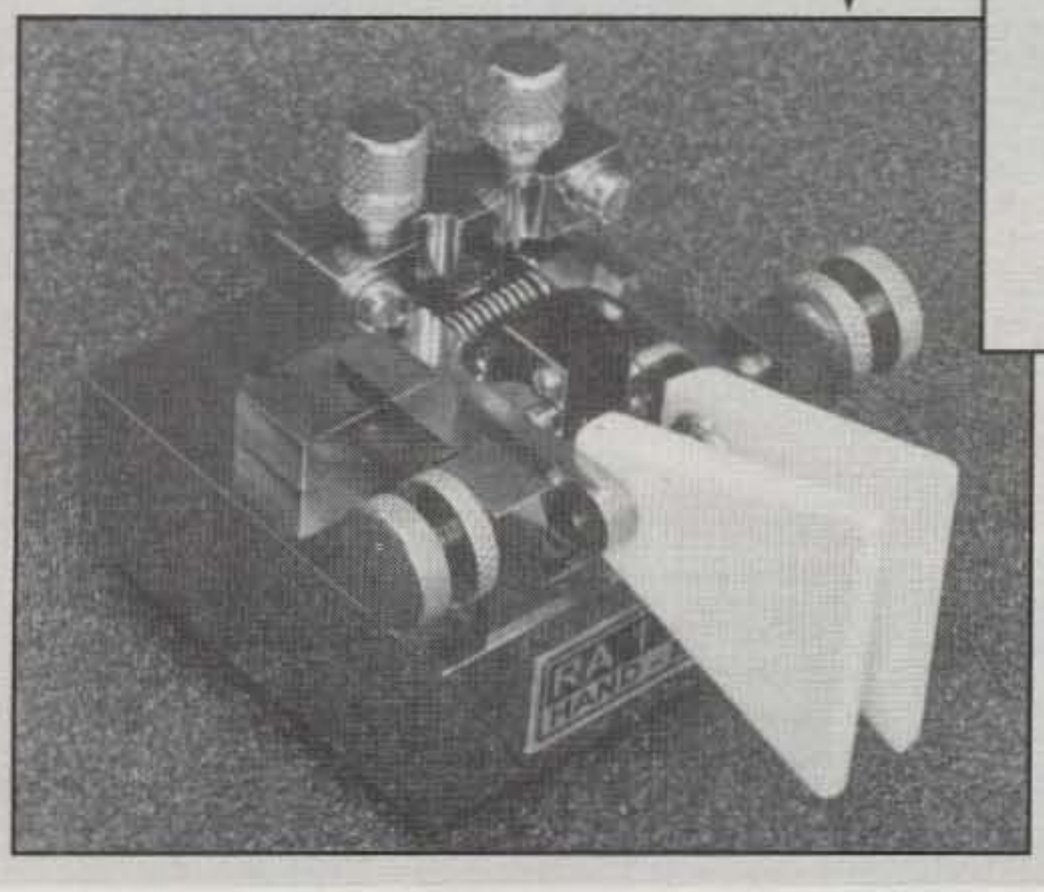


Photo 6– The fully restored Dow Key bug from Maine is a real showpiece and a collector's pride. The angled mechanism and dot/dash contact make the bug challenging but fun to use. (Bug photographs by proud owner Gary, WAØJRM)

Photo 7– This new miniature iambic paddle is made to order by Valery Pavlon, RA1AOM, in Russia. It is quite small and is chrome plated with teflon fingerpieces. It has an exceptionally smooth feel with positive action. Yes, a Russian key will also send CW in English. (Photo via Valery, RA1AOM)



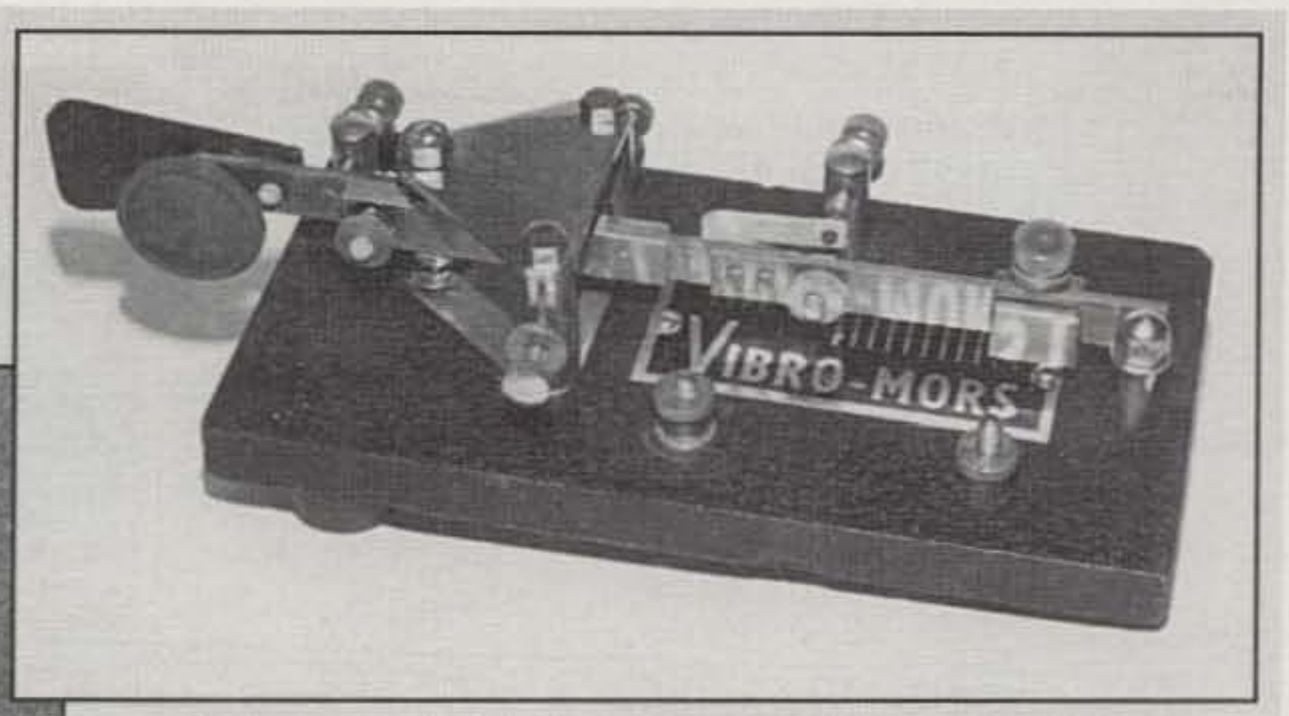


Photo 8– This like-new Vibro-Mors Bug was made in limited quantity by the French Post during World War II. It resembles a Vibroplex Champion except it is more low slung and racy looking. (Photo by master key collector Gil Schlehman, K9WDY)

and you can see that top-mounted pawl applying pressure against a small rubber bumper in the closest-to-fingerpiece weight's center.

When the fingerpiece is moved toward the left to make dashes, the flat right-angled, under-base arm pivots in the opposite direction. Now the weight-holding pawl does not move, but the under-base arm's end (that section pointing toward the white, insulated cable wire in photo 4) connects with the dash, adjusting screws end to make dashes. Freaky? Yes! Fun? You bet! Using this key on the air, is a blast!

Looking Ahead in CQ

Here are some of the articles that we're working on for upcoming issues of *CQ:*

- "Electricity Everywhere," by W6BNB
- "The Station Controller," by AF1US
- "A BASIC Stamp Serial Converter for ACC Controllers," by AH6LE
- "Contesting from A61AJ," by K2RED

Plus:

- "A Visit to MFJ," by W2VU
- "Add Scanning to Converted CB Rigs," by WB9YBM
- "The Aviator's Solution to Shack Noise," by KF2LF

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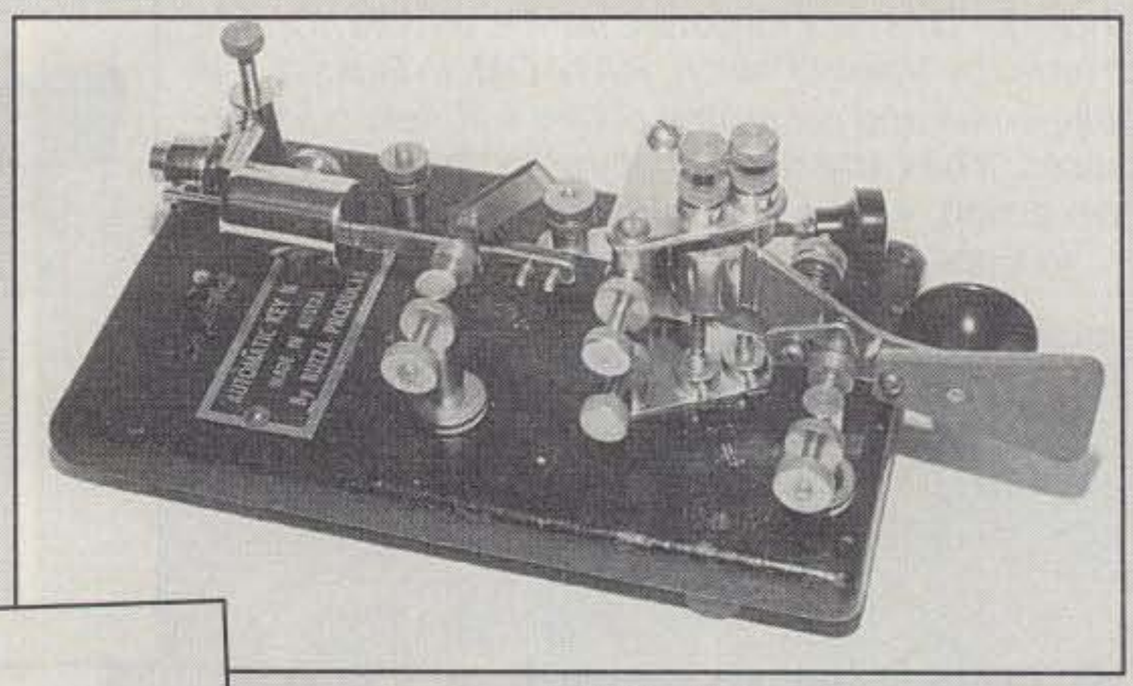

Photo 9– Australia was also well-known for its world-class bugs in the past, and this neat Buzza Products Bug is a shining example of that fact. The key sports twin pivot pins and a fancy yoke mechanism and works very well. (Photo courtesy proud owner K9WDY)

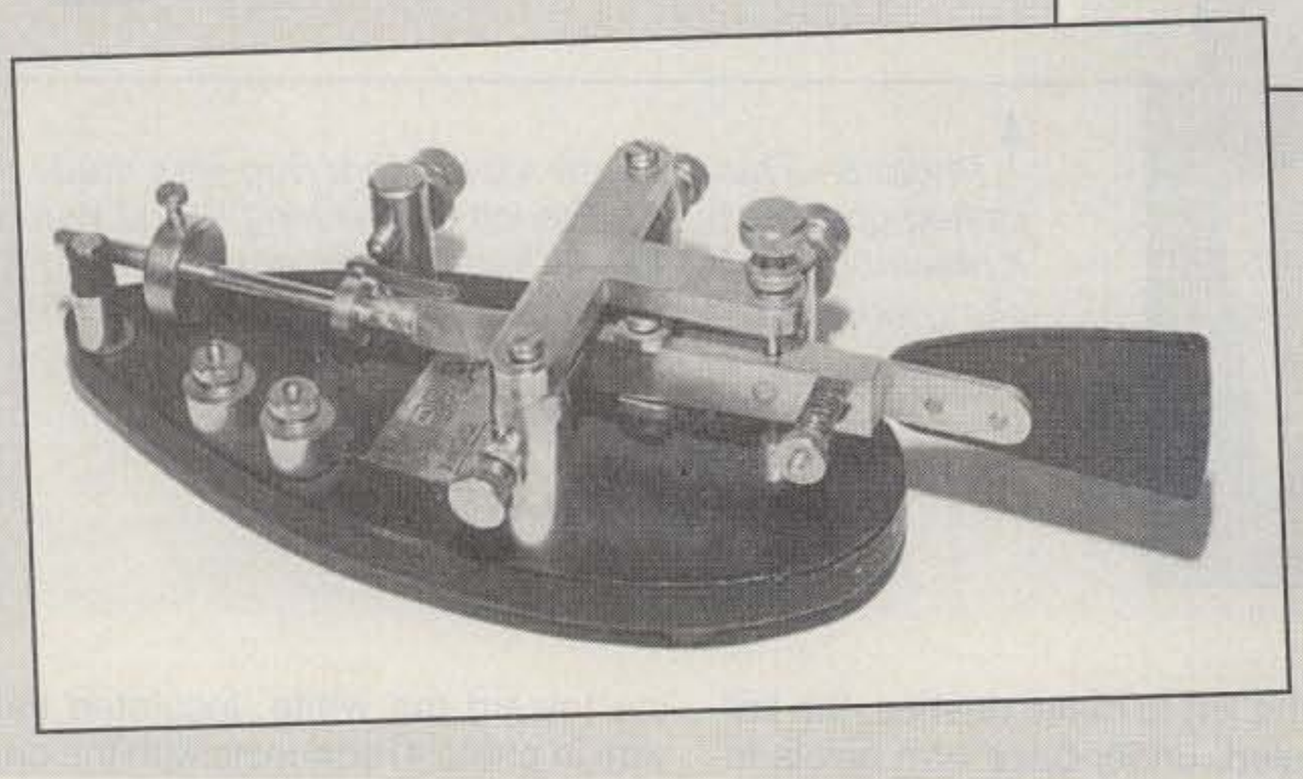

Photo 10– Here is something you do not see every day—a unique left-hand Italian Vibrax Model 3 bug. Imagine your hand on the fingerpiece, and notice dot and dash contacts are on the opposite-from-usual side. (Photo by Gil K9WDY)

Rescued Dow

A couple of years ago, Gary Reiss, WAØJRM, sent us a photo of a pitifully neglected Dow Key Bug he purchased at an auction and planned to restore (photo 5). The little bug suffered from extreme malnutrition, corrosion, and partial loss of a fingerpiece, but its unusual nameplate marked it as a true rare, genuine collectible. Although not fully visible in the photo, the nameplate reads "DOW KEY made by the Dow Key Company, Brewer, Maine, Canadian Plant, Winnipeg, Manitoba, Serial No. 1105." A Canadian bug made in Maine is most curious, so Gary did some background checking while restoring the key. The facts are still vague, but apparently the main-branch operation sidestepped some tariff entanglements or supported U.S. assembly of Dows. No records of Dow operations were found in Maine, and this is the only Dow we have seen with a Maine nameplate, so we can only surmise production was very limited.

In close study of Gary's exquisitely restored and replated Dow (photo 6), I notice the main yoke is thinner and more squared off at its edges than a regular Dow. In fact, the yoke looks (to me) as if it may even have been made by the famous Telegraph Apparatus Company of Chicago during the 1930s or 1940s. Possibly that was the reason for a Maine assembly point. Whatever the case, Gary now has a proud showpiece worthy of compliments.

New Russian Mini Paddle

Direct from Russian CW devotee Valery Pavlon, RA1AOM, comes news of the dazzling new miniature iambic paddle shown in photo 7. Valery handmakes this paddle for friends and fellow radio amateurs, not as a business venture, but as a hobby, and it handles great. The paddle measures approximately 2.5"H × 2.5"W × 2.75"D, is brilliantly chrome plated, and has solid white teflon fingerpieces. A spiral spring between the two fingerpieces establishes lever tension, and knurled screws atop the rear support bar fine-tune lever slack or "drag." Set screws with lock nuts beside each lever adjust their travel or gaps. A center block with chrome side plates and silver dot/dash contacts is mounted between the two levers. The paddle has a good feel and positive action at both high and low speeds, and you can get one of these gems made to order. Just contact Valery Pavlon, RA1AOM, at P.O. Box 98, St. Petersburg 197022, Russia for details. Yes, I sense many of you asking the same question and yes, a Russian paddle will send Morse code in English. That is, assuming you can send Morse code in English with a regular key or paddle!

What A Bug!

Now stepping up the pace, our good friend and key collector extraordinaire Gil Schlehman, K9WDY, offers some brief views of a few exotic bugs from abroad. First is the low-slung, sexy little French Vibro-Mors bug shown in photo 8. Notice this key's clean design and smooth lines, its triangular-shaped yoke or mainframe, its flat pendulum with square speed weight, and its close-to-fingerpiece pivot point. That combination of design characteristics should give it a unique feel and make it a real fun to use item. It's just like being a big-time telegrapher in the French Foreign Legion.

Buzza Bug

Another semi-automatic key with a striking resemblance to the French Vibro-Mors and Vibroplex famous Champion is the Buzza Products Company bug made in Australia during World War II (photo 9). This gem, also from the K9WDY collection, sports a similar (but taller) triangle yoke/mainframe and flat

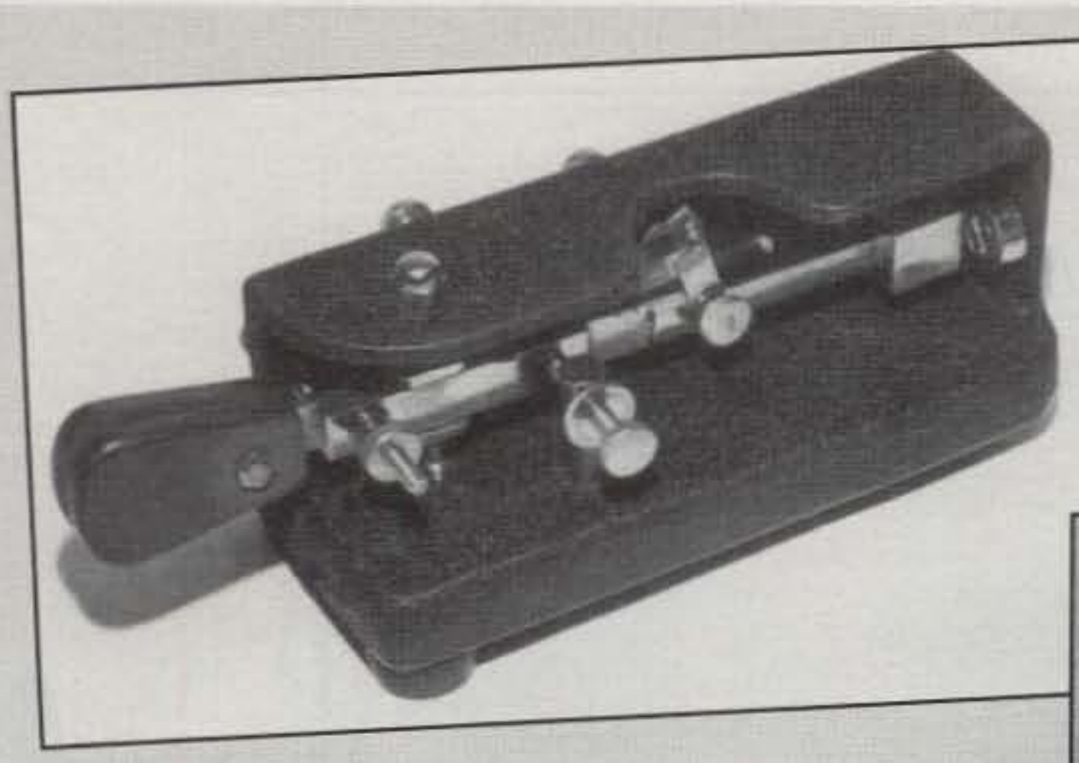

Photo 11– This little orphan bug has no name tag, but it is a doll! Notice the narrow base and half-cover over mechanism.(Photo by Gil, K9WDY)

Photo 12– This exceptionally large hand key is a Model 365 made by the Marconi Wireless Company in England. It was a popular item aboard British ships in recent times. (Photo courtesy proud owner Flavio Penido de Freitas, PY4BG)

pendulum. Notice, however, its speed weight is round. Look carefully and you will see two pivot rods and two pivot adjustment screws with locknuts atop the yoke. There is some fancy finger-piece arm-to-pendulum arm linkage within the Buzza's yoke. First class for sure!

Double Delights

The closing wire approaches, so let's quicken the pace to squeeze in some final views. First we direct your attention (and magnifiers) to photo 10, a rare left-handed Italian Vibrax Model 3 Bug of elegant simplicity. The key's base is shaped like McElroy's famous Teardrop bug or a flat iron; its rear damper post is chrome with a rubber bumper at the top, and long-arm travel-adjusting screws thread into left and right yoke support pillars. The fingerpiece is a single piece of blue lucite. Overall, this is a most unique key.

Next is an unusual bug with no markings or hint of its manufacturer (photo 11). The little tyke is quite compact, and its mechanism is well-protected from abuse. Setting gaps and speed weights seems rather challenging, yet we bet it is a real treat to use.

A Parting Shot

Our final keyvue for this month is the big-time Marconi 365 spark key owned by Flavio Pendio de Freitas, PY4BG, and shown in photo 12. Although not readily apparent, this key is quite massive (approximately 5" × 5" × 9"). It sports a solid-brass arm with protective shroud near its knob, a lavish ball-bearing assembly at the fulcrum, and heavy-duty contacts. The side nameplate reads "The Marconi International Marine Communications Co., London."

That wraps up our views for this time, gang, but stay tuned for more captivating key photos and tales next month. Meanwhile, keep working CW with those delightful keys and listen for me too on 30 meters week nights.

73, Dave, K4TWJ

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What's New

BY KARL T. THURBER, JR., W8FX

A New Column for A New Century

New Rigs and a New "Old" Key for the New Year

This month we bring you more radio gear, accessories, and software for the ham shack, just in time to chase away those winter doldrums! Let's start off with some new radio products from Ten-Tec and Alinco to pique your interest.

Photo A– With Ten-Tec's Pegasus PC Controlled Transceiver, your PC provides the "virtual" front panel and all the necessary controls. This reduces cost by eliminating expensive front panels, displays, etc. You don't have to be a computer expert to use Pegasus; it connects to your Windows®)-based PC via a serial port. Pegasus covers all nine HF bands plus general coverage on receive; it boasts many advanced digital features.

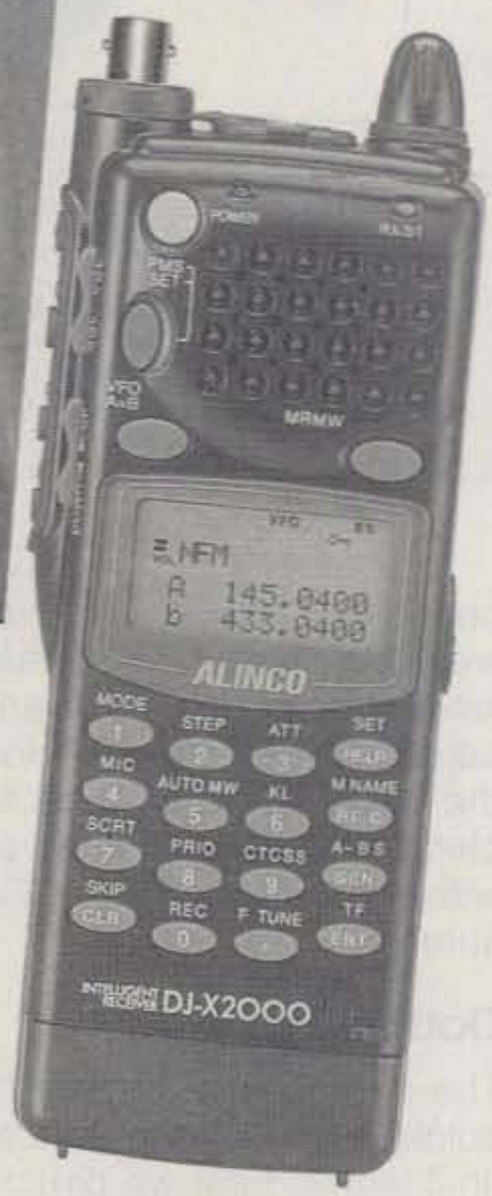

Photo B– Alinco recently introduced the highly advanced DJ-X2000, a hand-held, wide-range scanning receiver with a large number of upscale monitoring and listening functions. With continuous coverage all the way from 100 kHz to 2150 MHz (less only the cellular frequencies), the radio offers a very broad package of functions and features not often seen in other scanning radios. See the text of this month's column for details. (Photo courtesy Alinco U.S.A.)

Radio Gear

News from Ten-Tec. In a letter received from Ten-Tec top staffers Jack Burchfield, K4JU, and Tom Salvetti, KC3NF, was set forth some of Ten-Tec's philosophy. It's an interesting one that reflects the current times we (and amateur radio) live in.

They note that the marketing of amateur radio products has changed dramatically, and they remind us that there was a time when an amateur could buy just about everything for the hamshack from a local dealer. At the same time, amateurs received helpful tips and advice and assistance. However, this has changed. Today there are few local dealers. Most hams shop by toll-free numbers, searching for the best price. In this scenario the dealer is merely acting as a broker and must add operating costs and profit. This, unfortunately, increases the ultimate cost to the purchaser.

Ten-Tec broke with tradition in 1992, and it now offers all Ten-Tec products directly from the factory at what it claims are "low factory-direct prices." Nevertheless, Ten-Tec asserts that you still can get personal assistance from active amateurs and qualified technicians on their staff, before and after the sale.

Before turning to other gear, we should note Ten-Tec's move into futuristic, digital-signal-processing (DSP)-based HF transceivers. This move seeks to combine the power of your PC with IF-DSP technology. Actually, the marriage of PCs, DSP technology, and HF rigs has been underway for some time. However, Ten-Tec says it's the first to offer it at an affordable price.

Ten-Tec's first such entry is the Pegasus PC Controlled Transceiver (see photo A). With it your PC provides the "virtual" front panel and all necessary controls. This reduces cost by eliminating expensive front panels, displays, etc. It's all now done in software. You don't have to be a computer expert to use Pegasus; it connects to your Windows®-based PC via a serial port. Pegasus, at $895, covers all nine HF bands plus general coverage on receive, and it boasts a host of advanced digital features. Among them are dual VFOs with split mode, RIT/XIT, passband tuning, adjustable AGC, variable CW offset with sidetone, and more.

Another related new product is the 20 watt, 6N2 All-Mode VHF Transceiver. It reportedly is the first IF-DSP design in an all-mode VHF transceiver, offering FM, SSB, and CW operation on both 6 and 2 meters. Its flexibility lets the 6N2 double as your main FM rig in the shack or as a fine mobile rig. You can even leave the antennas for both bands connected at all times; the rig knows which antenna to use. Pricing is under $800.

For more information, contact Ten-Tec, Inc., 1185 Dolly Parton Parkway, Sevierville, TN 37862-3710 (1-800-833-7373; e-mail: <sales@tentec.com>; web: <www.tentec.com>).

New Hand-Held from Alinco. Alinco is understandably bursting with pride in its new DJ-X2000 (photo B), a "new generation," hand-held, wide-range scanning receiver that should be in the marketplace this month. With continuous coverage all the way from 100 kHz to 2150 MHz (less only the cellular frequencies), the radio offers a very broad

**289 Poplar Drive, Millbrook, AL 35054-1674*
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Photo C– Jensen Tools stocks a neat new tool, the Panasonic 3.6V Cordless Screwdriver Kit. This powerful but compact screwdriver offers a high degree of torque accuracy. The auto shutoff clutch extends battery and clutch life by immediately stopping rotation once the torque setting is reached. The dual-speed unit uses a 3.6 V, 1.2 Ah battery. The kit includes the driver, a 15-minute fast charger, a battery pack, and two bits. (Photo courtesy Jensen Tools)

package of functions and features not often seen in other scanning radios. The new unit receives most common communication modes, including CW, wide FM, narrow FM, AM, USB, LSB, and FM stereo broadcasts. Although the radio is targeted specially for professionals in public safety and newsgathering operations, its many features make it useful for a wide variety of upscale monitoring and listening functions. The DJ-X2000 features alphanumeric channel naming, is computer programmable, receives FM stereo broadcasts, and has an instant "Flash Tune"™ feature that can lock onto nearby signals, a frequency counter for checking radios in the field, and a digital recorder that can record a user voice memo or received audio for over two minutes. The radio, which is tentatively priced at $650, also can decode CTCSS tones commonly used by FM transmitters and can even associate a tone with a given memory channel. Alinco cautions that it expects a strong demand for the DJ-X2000, saying it may take some time for production to catch up with demand.

For more information, contact Alinco U.S.A., 438 Amapola Ave., Suite 130, Torrance, CA 90501 (310-618-8616; web: <http://www.alinco.com>).

Accessories for the Shack

New Tool and Catalog from Jensen Tools. Jensen Tools now stocks a neat new tool, the Panasonic 3.6V Cordless Screwdriver Kit (photo C). This powerful but compact screwdriver offers a high degree of torque accuracy; an included calibration chart indicates torque for each clutch setting. The auto shutoff clutch extends battery and clutch life by immediately stopping rotation once the torque setting is reached. The dual-speed unit uses a 3.6 V, 1.2 Ah battery. The kit includes the driver, a 15-minute fast charger, a battery pack, and two bits. It has a one-year manufacturer's warranty.

Jensen Tools also has released a new Communications Catalog. This 116-page, full-color catalog offers a wide range of tool kits; hand and specialty tools; cable, telephone, and electrical test equipment; and service aids. The items from this catalog also can be found online at their website.

Contact Jensen Tools, Inc., 7815 S. 46th Street, Phoenix, AZ 85044-5399 (1-800-426-1194; e-mail: <jensen@stanleyworks.com>; web: <http://www.jensentools.com>).

New from Milestone Technologies/ Morse Express. In last October's column we profiled Milestone Technologies and noted their FingerTappers™ keys, sold under the Morse Express name. As we indicated, Marshall Emm, N1FN, offered a new Straight Key as well as a Single Lever Paddle in this series. In the meantime, he's introduced a steady stream of keys, paddles, bugs, and other accessories, including cleaning products.

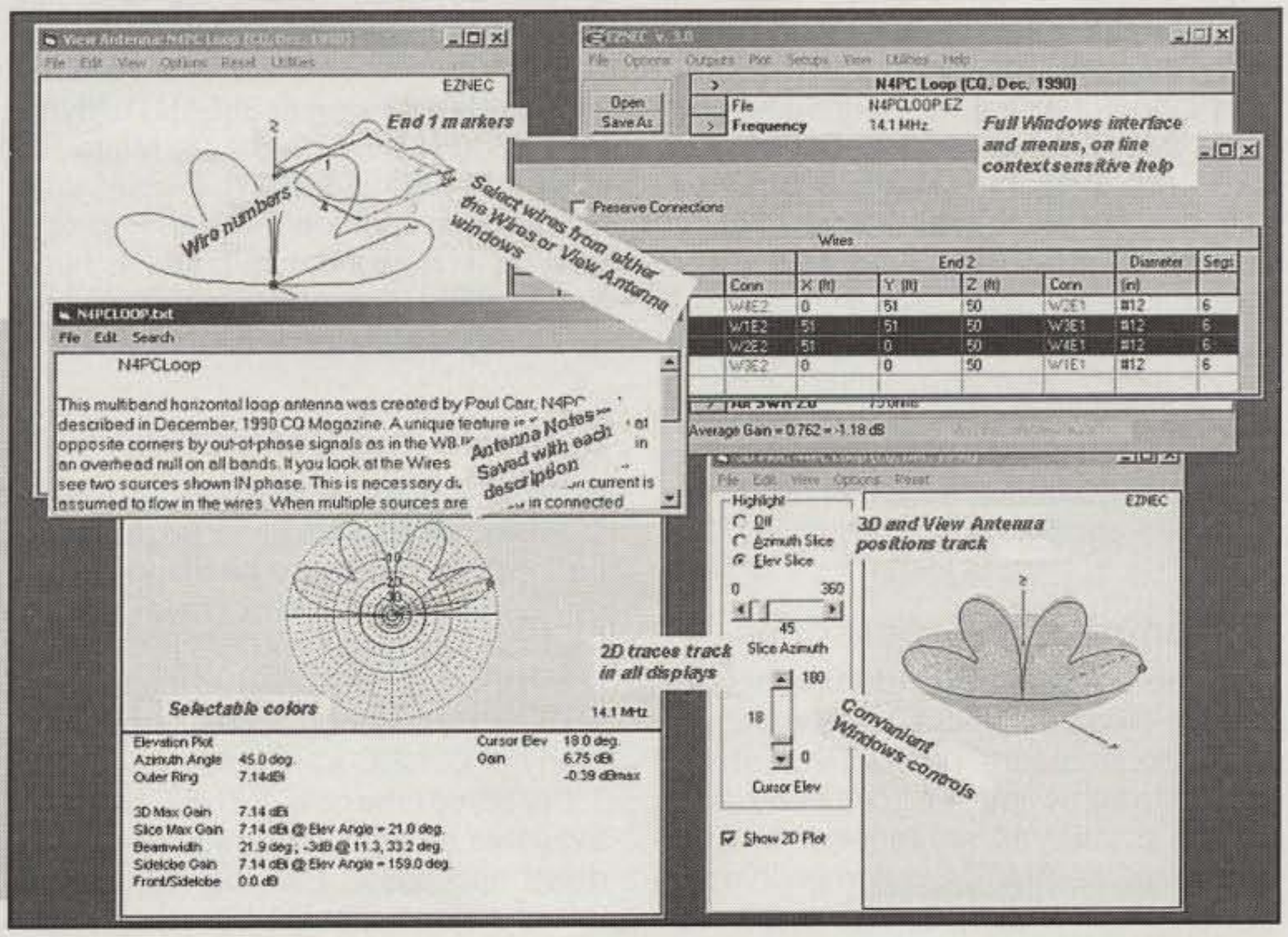

Fig. 1– EZNEC 3.0 is an easy-to-use program that takes advantage of the powerful NEC-2 calculating engine. You can use EZNEC for modeling and analyzing practically any kind of antenna. All information, including patterns, can be displayed on screen or printed out. The program is quite user-friendly, with its logical menu structure, spreadsheet-like entry, and many shortcut features. (See the text of this month's column for details.)

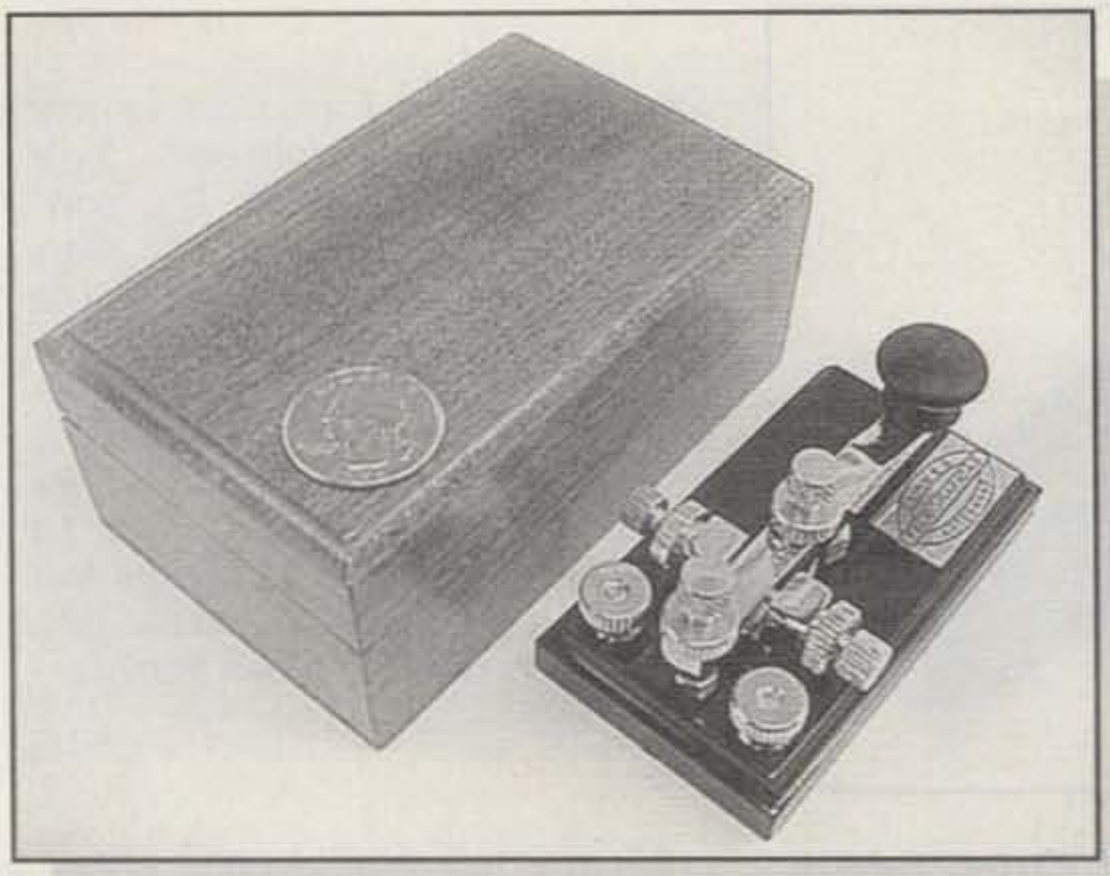

Photo D– Recently, Morse Express introduced a limited edition Millennium Key. It has the same mechanism as the LTA Model GMO Key, but it has several special features. Each key is made with hand-selected parts and is highly polished and gold plated; the knob and ebony base present a striking appearance. The key comes in a presentation quality, red-felt-lined wooden box.

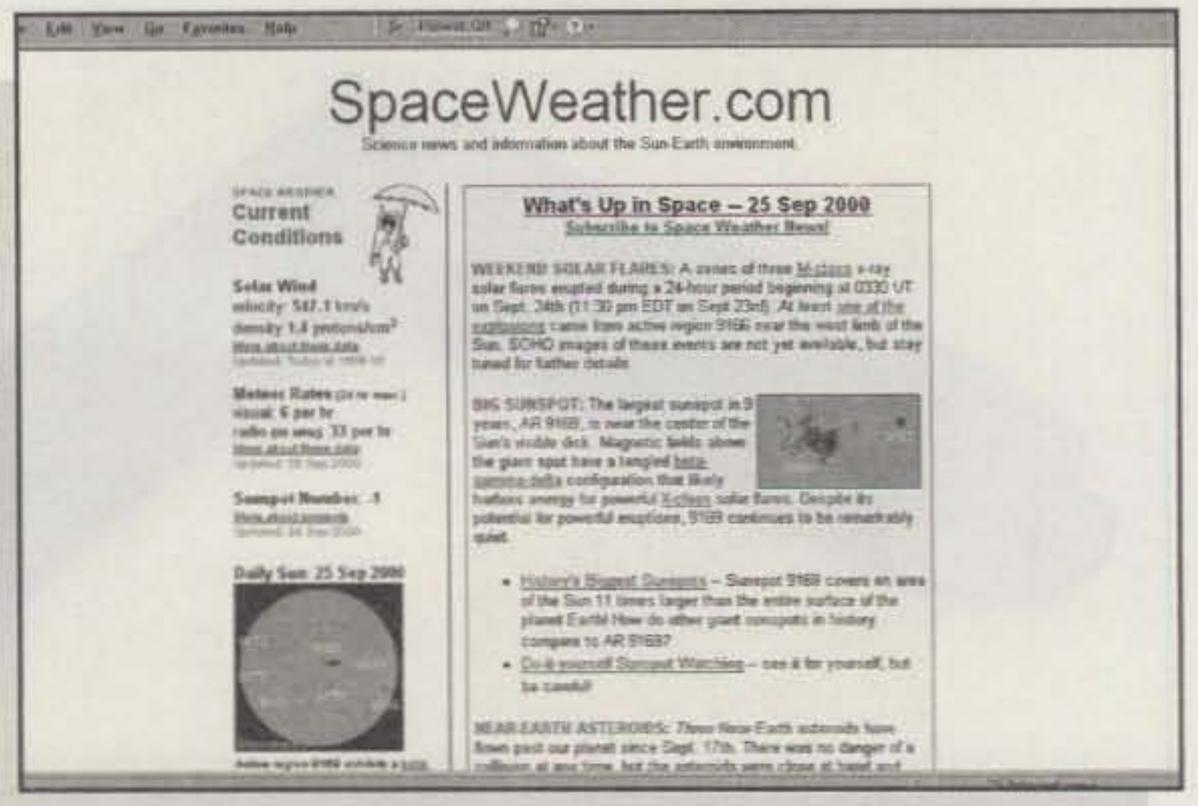

Fig. 2– The Space Weather Bureau Website makes an excellent online resource for those interested in all things geomagnetic and solar. Supported in part by both NASA and NOAA, and operated by Bishop Web Works, it's The Space Weather Bureau, at <http://www.spaceweather.com>. The site provides current solar wind conditions, meteor rates, sunspot count, coronal hole information, aurora alerts, and links to all manner of interesting and useful information. Check it out!

Recently, we found Morse Express offers a limited-edition Millennium Key (photo D), a precision key made by Llaves Telegraphicas Artisanes, located in Spain's Balearic Islands. Marshall notes that the Millennium Key has the same mechanism as the LTA Model GMO Key, but has several special features. Each Millennium Key, at $89.95, is made with hand-selected parts and is highly polished and gold plated; the knob and ebony base present a striking appearance. Each key has a certificate showing its serial number and further identifying it. The key comes in a presentation-quality, red-felt-lined wooden box. Many other Morse-related products are available. These include the HP1TK Soviet Key and a new version of the popular FingerTappers Single Paddle Key.

Contact Morse Express, a division of Milestone Technologies, Inc., 2460 S. Moline Way, Aurora, CO 80014-1833 (phone 1-800-238-8205; e-mail: <nifn@MorseX.com> web: <http://www.morseX.com>).

Antennas and Accessories

Online Antenna World Catalog. Antenna World may not be all that familiar to radio amateurs, but it's been around for quite some time. The company set up shop in 1982 as an importer of European-made AM/FM automobile radio antennas; later they added Asian-made products and cellular antennas. In 1990 the company began designing and manufacturing cellular antennas in-house.

Today Antenna World makes all of its VHF, UHF, and 800/900 MHz antennas in-house. Their products cover the two-way commercial and amateur, cellular, 800/900 MHz commercial, and wireless low-power bands. Omnidirectional and Yagi-type antennas, as well as hemispherical designs, are offered. The firm can custom-design almost any type of antenna to a customer's requirement.

For more info, contact the Antenna World retail division at 888ANTENNAS, Inc., 9500 N.W. 12th St. #5, Miami, FL 33172 (1-888-268-3627; e-mail: <888@antennaworld.com>; web: <http://www.antennaworld.com/products.htm>. You can find most of the items they offer in the print catalog in the online catalog.

Software and Computers

EZNEC 3.0 for Windows. In August 1993 we discussed ELNEC, an antenna modeling software package offered by Roy Lewallen, W7EL. Later we profiled the fuller-featured EZNEC. As we noted then, EZNEC had all the features of ELNEC, and then some, overcoming many of ELNEC's limitations.

For some time now, EZNEC has been available as a full-featured, 32-bit Windows application (see fig. 1). EZNEC 3.0 is a very capable but easy-to-use program that takes full advantage of the powerful NEC-2 calculating engine. You can use EZNEC for modeling and analyzing practically any kind of antenna in its actual operating environment.

EZNEC plots azimuth and elevation patterns; tells you gain, feedpoint impedance, SWR, and current distribution; finds and reports beamwidth, 3 dB pattern points, front-to-back (F/B) ratio, take-off angle, side-lobe characteristics; and more. All information, including patterns, can be displayed or printed out.

The program is quite user-friendly, with its logical menu structure, spreadsheet-like entry, and shortcut features. EZNEC lets you describe the antenna as a group of straight conductors, choosing the orientation, length, and diameter. Using this description method, you can quickly analyze nearly any type of antenna or antenna structure, saving the descriptions and pattern plots for later display and manipulation. The program has 500-segment capability, which lets you model very complex antennas. EZNEC also features an innovative 3D pattern display.

EZNEC 3.0 is available by direct download over the web for $89, or on CD-ROM for $99 (plus $3 for CD-ROM delivery outside the U.S. and Canada). You also can become familiar with EZNEC by downloading the free demo program; it's complete except that it's limited in the complexity of the antennas it can analyze.

For further details on EZNEC 3.0 contact Roy Lewallen, W7EL, P.O. Box 6658, Beaveton, OR 97007 (503-646-2885; e-mail: <w7el @eznec.com>; web: <http://eznec.com>).

ID Wizard from Taborsoft. The Kangaroo Tabor Software website is sponsored by Jim Tabor, KU5S. It features several useful software tool programs, especially tools designed for those interested in communications analysis and current and future solar conditions. These tools include Active Beacon Wizard ++ and WinCAP Wizard 2.0, both of which we profiled in previous columns. Be sure to check out Jim's website, which you'll find at <http://www.taborsoft.com>.

Jim recently released another "downloadable" software product called ID Wizard. It's QSLware, which means it's basically free. The only catch is that he asks users to send an e-mail message with their comments about the program.

ID Wizard is an ID timer with system clock settings and miscellaneous tools. These tools include Notes, a full-featured text editor; Calculator, which has a tape display; Net Utility, which lets you check your Internet routing; and precision system clock time setting via the Simple Network Time Protocol.

The program's clock face is particularly interesting; it displays when the ID timer fires. Two clock faces are provided as defaults, while others are user configurable. You can download the program at <http://www.taborsoft.com/softstuff.idwiz>.

Jim also asked us to mention that last summer he released a "fancy" ID timer, dubbed the NERDAlert 2000. Although the program is presented in a "fun" spirit, it's also a capable ID timer. It can be downloaded at <http://www.hamtools.com/nerdalert>.

Contact Kangaroo Tabor Software, Rt. 2, Box 106, Farwell, TX 79325-9430 (fax: 806-225-4006; e-mail: <jim@ taborsoft.com>; web: <http://www.taborsoft.com> or <http://www.hamtools.com>).

New on the Net

Operation CQ. Michael Carroll, N4MC, is the project manager and driving force behind Operation CQ, the U.S. Amateur Radio Call Sign History Restoration Project. Michael invites us to be a part of this history-making effort. So what's it all about?

Operation CQ represents a massive effort to reconstruct and document amateur radio callsign historical information before it's too late, since digging through old callbooks soon will become a thing of the past. The project is a nationwide effort to document and provide online all of your previous callsign information, from as far back in time as you can go.

To provide this assistance, Michael asks us to go to his web page, at <http://www.n4mc.com>. Once there, you'll proceed to the Registration and Edit Form to document your callsign history. The form contains the necessary and detailed information for you to submit information online. Michael says he will compile a searchable database to be available online soon.

For more info, contact Michael at e-mail: <michael@carroll-usa.com>; web: <http://www.n4mc.com>.

The Space Weather Bureau Website. Earth's "space weather" still is rather turbulent as we come off the 11-year solar cycle peak. In our "Uncle Sol" feature article series "Uncle Sol's Solar Wind and the Earth's Magnificent Magnetosphere," which appeared in August and September 2000 *CQ*, we took a close look at the fascinating solar-terrestrial phenomena involved: the Sun itself, the Solar Wind, and the Earth's magnetosphere.

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We noted that many government agencies, foreign governments, universities, and others were involved in predicting the solar cycle and monitoring solar activity. We also noted several interesting and useful websites that you can use to keep up with all this activity. The problem is, no one website seems to provide all, or even nearly all, the information you might want.

Astute reader Kevin McQuiggin, VE7ZD, found a "do it all" website that makes an excellent online resource for those interested in all things geomagnetic and solar. Supported in part by both NASA and NOAA, and operated by Bishop Web Works, it's The Space Weather Bureau, at <http://www.spaceweather.com> (fig. 2). The site provides current solar wind conditions, meteor rates, sunspot count, coronal hole information, aurora alerts, and links to all manner of interesting and useful information.

Kevin says that he uses the site on a daily basis, and once you check it out, you may, too.

Note: Check out the two excellent articles that effectively continued my Uncle Sol series, both of which appeared in last October's issue. One is "Measuring Geomagnetic 'Weather,'" by Ken Neubeck, on p. 28; and the other is "NOAA's New Space Weather Scales," by Dr. Theodore J. Cohen, N4XX, on p. 65.

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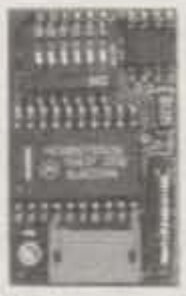

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From the Bookshelf

Two New Computer Books from Macmillan. As I've said before, sometimes I think Macmillan, with its many book imprints (Que, Sams Publishing, New Riders, etc.), is becoming the Microsoft of the computer publishing industry. It would seem that as the amount of "real" (read *printed*) software documentation provided by software publishers decreases, and users need more help to use their purchases, book publishers such as Macmillan go into high gear with their plain, old-fashioned-paper help books.

If you have upgraded to the Windows® 98 follow-on, Windows Millennium Edition ("Windows Me") or are considering doing so, you might want to check out Faithe Wempen's Microsoft Windows Millennium Edition. The 575-page Que®) book explains, in plain English, the most important Windows Me features and skills that the average person might want to master. The $24.99 softcover book does a good job of explaining just what is new and useful in Windows Millennium, and it goes on from there.

On a completely different tack, a fascinating (and somewhat scary) book is Richard Power's *Tangled Web: Tales of Digital Crime from the Shadows of Cyberspace*. Based on the reality that cybercrimes are becoming commonplace, the author of *Tangled Web* conducted extensive interviews with hackers, investigators, prosecutors, and other security experts. His book provides us with an inside look at the "shadow world" of cybercriminals, cybercops, corporate spies, and info warriors.

As the book unfolds, he convinces us that as our increasing connection to each other affords better interaction and communication, it also opens Pandora's box to outsiders to steal our moey, our ideas, our information, and even our identity—not to mention attack and even destroy our national infrastructures. The illuminating, but chilling, 431-page Que hardback is $25.

Contact Macmillan Publishing USA, 201 West 103rd Street, Indianapolis, IN 46290-1097, 1-800-858-7674, for a catalog; e-mail: <info@mcp.com>; web: <http://www.mcp.com>.

Wrap-Up

That's all for this time, gang. Next time, more "What's New." See you then.

Overheard: I have found that a simple, five- minute job can take me a full two years if I really delay and procrastinate!

73, Karl, W8FX

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Radio Classics

BY JOE VERAS, N4QB

Vintage Gear and Its History

Post-War VHF/UHF Gear

My previous "Radio Classics" column covered equipment from the early, pre-WW II years of VHF/UHF. This time we'll stroll a few evolutionary steps closer to the gear we use for that spectrum today.

Even if you're younger than the equipment discussed in this column, read on anyway. A sense of history is a useful adjunct to the enjoyment of any hobby. Besides, the stork didn't really bring you to mommy and daddy's house, and the HT wasn't invented by a brilliant engineer at Yaesu/ICOM/Kenwood.

With the dogs of war once again muzzled and leashed, amateur radio, and civilian life in general, attempted to return to normal in the mid-1940s. In the hobby, and elsewhere, *normal* would not be the pre-war status quo. The consequences of wartime forced many people to look forward rather than backward.

K. B. Warner, writing in *QST*'s "It Seems To Us" column, gazed into the crystal ball in a series of editorials appearing in 1945. I don't know whether to credit his musings to prescience, forward-thinking, or blind luck, but some of them turned out to be very close to the mark. What I do find fascinating is the length of time it took some of them to be implemented.

Warner foresaw an exciter with frequency control via a series of numbered keys. When the keys were pressed, the frequency would pop up in a little window, "like a cash register," and the transmitter would move there. Interestingly enough, the first digital readouts functioned more on the order of a gasoline pump's price-and-gallons indicator than a cash register.

One-knob frequency control for the entire station was also suggested. Tapping into the receiver's HF oscillator and combining it with a crystal-controlled signal (equal to the receiver IF) in an external mixer makes possible a VFO that tracks the received frequency. In an extension of this "transceiver in several different boxes" idea, Warner also called upon receiver manufacturers to construct their products so that the existing audio output chain could do double duty as the speech amplifier circuitry for a transmitter. He suggested that amateurs would take it upon themselves to work out the transmitting details at their own workbenches.

Somewhere in the future Warner believed there would be automatic, two-way relay stations operating at VHF. Sounds kind of like repeaters, huh? He also proposed control of offsite HF stations through UHF links. In this day of ham-unfriendly CC & R's and no-antenna ordinances, such an idea is attractive. Today, though, the control might better be done with computers.

Frequency modulation, in its narrow-band form, was touted as a mode for future prominence, even on HF. The audio power requirements were considerably less than conventional AM, and it was believed to enjoy a signal-to-noise advantage.

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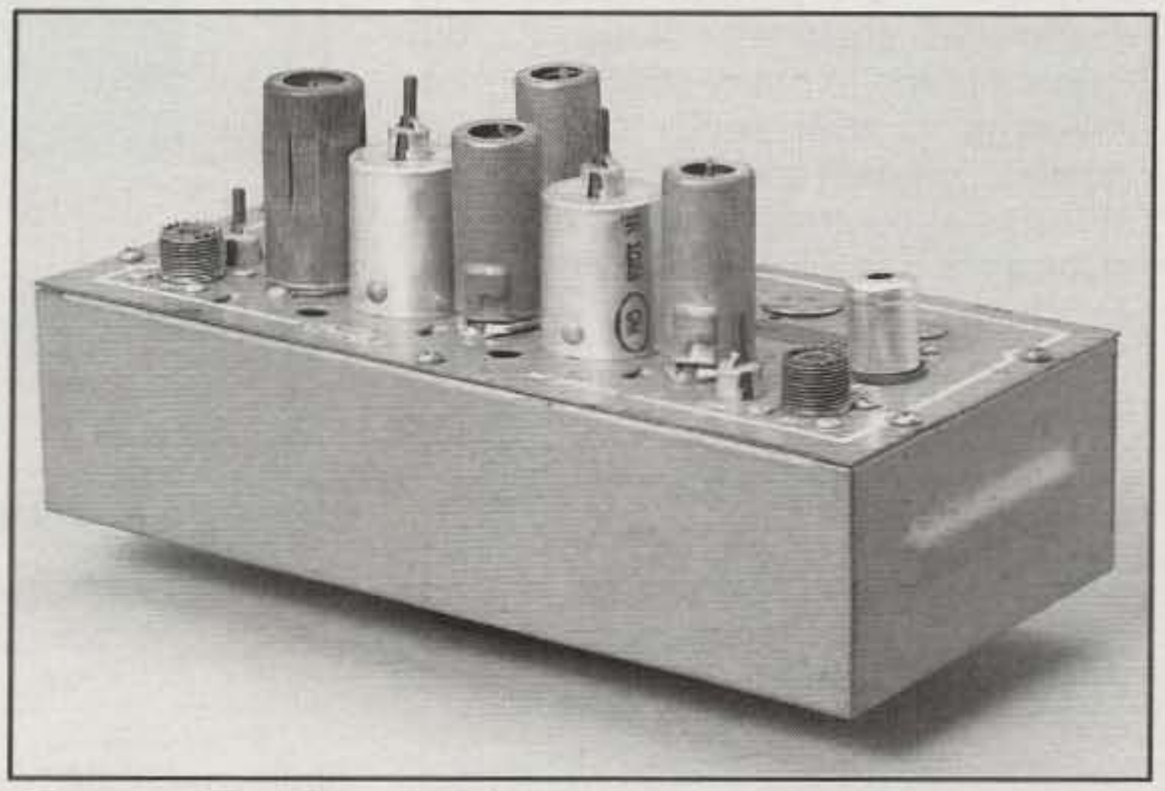

Photo 1– The Tecraft CC-50 6 meter converter is representative of the converter-ahead-of-HF-communications-receiver school of thought. (All photos by Joe Veras, N4QB)

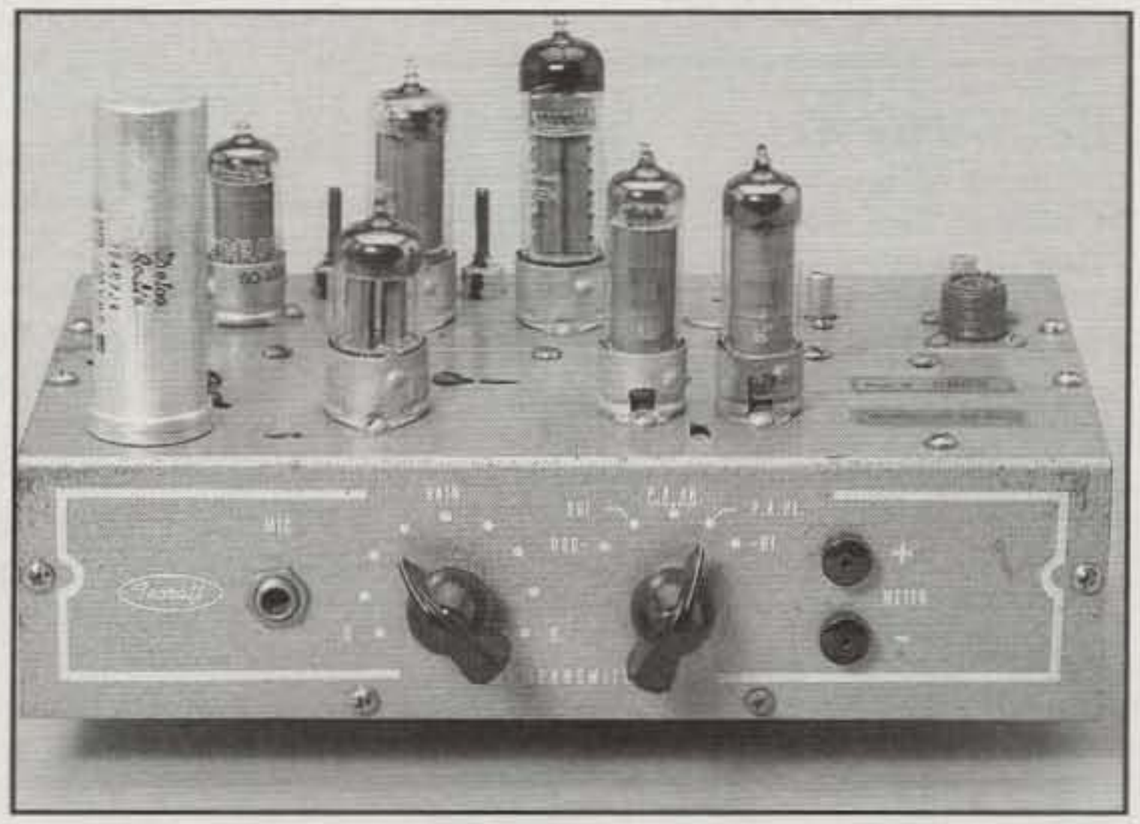

Photo 2– The Tecraft CC-50 was often used in conjunction with the Tecraft TR-20/50 transmitter, pictured here.

Near the end of the war, in making its plans for the future, the FCC divided the spectrum at 25 MHz. As far as amateur radio was concerned, it was easiest to begin in the upper half of this division, at VHF. When peace arrived, these frequencies would be the first to open. The Commission believed it might be a long time, perhaps years, before the military loosened its grip on the HF spectrum. The new 2 meter ham band could be used immediately, and the allocation on 6 meters awaited only the shifting of some television frequencies.

Ham radio returned to the airwaves shortly after V-J Day, and as predicted, the VHF/UHF frequencies were the first to open. Even an amateur who had been a permanent resident of, say, 75 meter phone in the pre-war days found the wide-open spaces of these new bands to be powerfully attractive.

They presented the first opportunity for active participation in the hobby in a long while, and new challenges, as well.

The status quo for post-war VHF gear tended to supplement the existing HF station, especially in the receiving department. RME got into the act early on with its tunable VHF converter for 6 and 2 meters. The VHF-126 was styled to match RME equipment of the day, but found a home in many shacks regardless of the receiver brand present there. Another common approach was the use of a crystal-controlled converter ahead of the station receiver, which functioned as a tunable IF.

Photo 1 is a Tecraft CC-50 6 meter converter. It is representative of the converter-ahead-of-HF-communications-receiver school of thought. Similar equipment was made by Telco, Tapetone, Vanguard, and others. Tecraft products were manufactured by The Equipment Crafters, located in Teterboro and South Hackensack, New Jersey. The CC-50 cost $44.95 when introduced in 1959. The version pictured here with a nuvistor RF stage became available in 1963. It was frequently used in tandem with a transmitter such as Tecraft's TR-20/50 (photo 2). A 6360, plate-modulated by a pair of 6AQ5s, gave the TR-20/50 20–25 watts input on 6 meters. The transmitter sold for $59.95 in 1959.

Photo 3– The Clegg Zeus, a VFO-controlled, 175 watt, AM and CW transmitter for 6 and 2 meters, cost $559 when introduced in 1961.

I must confess, I did not operate 6 meters in the good old days of the '50s and '60s. Being a kid who lived in a location blessed with fringe-area, channel two television reception might have had something to do with it. My friend George Maier, K1GXT, logged a lot of time there, though, beginning as a 6 meter SWL before he was licensed. The recounting of his experiences has given me a vicarious taste of what it was like to be on the "magic band" in those days.

George particularly remembers the sense of camaraderie and community among the 6 meter crowd back then. The day-to-day 6 meter coverage was local in nature, and one quickly became acquainted with those hanging out on certain frequencies in a geographical area. No doubt it was similar to the early days of 2 meter repeaters, although the mode in use was more likely AM than FM, with no "machine" involved.

VHF gear eventually moved away from devices designed to adapt HF equipment for use on the higher frequencies to stand-alone transmitters and receivers. Photo 3 shows the Clegg Zeus, a VFO-controlled, 175 watt, AM and CW transmitter for 6 and 2 meters. The Zeus cost $559 when introduced in 1961; the bottom line rose to $695 in the next year. A companion receiver, the Interceptor (photo 4), sold for $473. It received SSB, in addition to AM and CW, employing nuvistors in the RF stages for good noise-figure performance. The Clegg name, already a familiar one in VHF/UHF circles when the Zeus and Interceptor were introduced, remained so for the next couple of decades.

The common, present-day configuration of the everything-in-one-box station had its devotees in the early years, too. Polytronics Laboratories of Clifton, New Jersey showed off the Poly-Comm PC-62 transmitter/receiver in 1962. It featured a triple-conversion, superhet receiver along with an 18 watt input AM transmitter and covered both 6 and 2 meters. The fully-tunable receiver and VFO-controlled transmitter provided frequency flexibility. Although admitting to a wandering VFO, the company's advertisements stated that its "Antennas did not drift." Well, that's a relief! The $349.50, 16-tube radio came complete with built-in AC and DC power supplies. Polytronics later released single-band versions of the PC-62, designated the Poly-Comm 6 and Poly-Comm 2.

Perhaps the best-known of the early VHF transmitter/receiver combinations is the Gonset Communicator. When introduced in early 1953, it was known simply as the Gonset 2 meter xmtr-receiver. By mid-year it had acquired the name Communicator. The succeeding model, pictured here (photo 5), appeared in early 1954 and was dubbed the Communicator II. It shared with the previous model a built-in 115 VAC/6 volt DC power supply, a 5–7 watt output power, and a "magic eye" tuning indicator. Both Gonsets also had a receiver that tuned from 144–148.3 MHz and crystal-controlled transmitters. The Communicator

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Photo 4– A companion receiver to the Clegg Zeus, the Interceptor received SSB, in addition to AM and CW.

Photo 5– Gonset's Communicator II, an early VHF transmitter/receiver combination and the successor to the Communicator, added an audio squelch circuit and a jack for headphones.

II added an audio squelch circuit and a jack for headphones.

Joining Gonset on the West Coast, Centimeg Electronics of El Segundo, California manufactured a line of converters and transmitters for the 432 MHz band. Pictured here (photo 6) is the Centimeg 432 transmitter. Its 2C39A final amplifier tube yielded 10 watts output on the 3/4 meter band. It carried a price tag of $184.50 in 1959.

By the mid-1960s dozens of companies offered scores of radios for the VHF spectrum. Most were AM/CW rigs, but SSB was also gaining in popularity. The number of radios produced in that era is beyond the scope of a magazine column; indeed, it would take a book to include them all. Coincidentally, I am currently working on such a book. Later that same decade the FM repeater business reached critical mass, beginning the explosion that still echoes across the radio landscape today.

Photo 6– Pictured here is the Centimeg 432 transmitter. Its 2C39A final amplifier tube yielded 10 watts output on the 3/4 meter band.

(The Gonset Communicator II featured here this month belongs to Don Zielinski, KØPV. All of the other equipment pictured is from the extensive collection of Herman Cone, N4CH. My thanks to both for allowing me to photograph their vintage gear.)

I am writing this in the closing days of the 20th century. (Yes, I'm one of those The-New-Millennium-Begins-in-2001 guys. Well, if 2001 were just another insignificant number, they wouldn't have used it for a movie title!) In any case, I would like to use the closing days of the year and the rest of this column to take care of some personal business.

First of all, thanks to all those who have written and e-mailed commenting on past columns. I was especially delighted to hear from Chris, K9JQE, a friend from my own early days in ham radio back in Green Bay, Wisconsin. If you know Chris, ask him about the time there was nearly a county-wide search for his Johnson Viking Mobile-equipped Vauxhall automobile. Chris had been kind enough to give me and my buddy Nels, K9QDB, a ride to the Green Bay Mike & Key Club meeting, and . . . uh, well . . . we didn't exactly come straight home afterward. I wouldn't say my parents were frantic—no, concerned is more like it. As the hour grew later, they became more, well . . . *concerned.* Alas, it was a more innocent time, when the most trouble a boy could get into was detouring to Scray's hill in an effort work some late-night DX with a friend's mobile setup. The story ends happily, and we remain friends 40 years later.

My thanks for a remarkable experience go out to Ali, A61AJ. He hosted several of the *CQ* gang, as well as operators from several DX entities, for the CQ World-Wide Contest in November. Although not technically a Classic Radio event, there *were* vacuum tubes in the half-dozen Alpha 87A amplifiers scattered throughout his magnificent ham shack.

I close out this column with a shameless, totally self-serving reminder that as you read this around the first of February, there is still time to purchase a 2001 Radio Classics Calendar. Even now, you will have more than a year of calendar to enjoy (it covers 15 months). They are available direct from *CQ,* through many vendors, and can be found at most of the upcoming hamfests. I'll look forward to seeing many of you at Orlando, Dayton, and stops in between.

73, Joe, N4QB

DX

BY CARL SMITH, N4AA

News Of Communication Around The World

New Postage Rates

As I write this, we are preparing for the Christmas/New Year's holidays. When you read it we will be well into the New Year, so let me wish everyone a Happy New Year. I hope 2001 provides everything you desire.

The Central Arizona DX Association (CADXA) 25th anniversary/reunion. Left to right: N7CW, W7IUV, K7SA, N7US, W7XA, K7BHM, K7NN, AA7A, W7RV, N7RK, K6AIA, K7SP, N7MW, N7RT, NE7X, and NN6R. (Photo courtesy Bob, K7BHM)

3B6RF, Agalega DXpedition Update

This operation, scheduled for last year, had to be postponed due to circumstances beyond the control of the team. They now have announced the rescheduled dates of May 5–18. The group consists mostly of HB ops, plus 3B8CF, 9A4TU, CT1AGF, DL3KUD, DL6UAA, F6HMJ, G3KHZ, and NK6F.

Bhutan

Bhutan certainly has seen its share of activity in the past year. From the beginning operation last May by the A52A Team and Jim Smith, A52JS, we have seen a number of operations by groups and individuals from around the world.

Glenn Johnson, WØGJ, the Team Leader for A52A, is back in Bhutan at this time with his entire family until early February. They will be living in Thimphu for about six weeks. Glenn, WØGJ/A52GJ, and his son Mark, NØMJ/A52MJ planned to be on all bands and modes, including PSK31 and Hellschreiber. Emphasis will be on the low bands and sunrise/sunset. Glenn will be working at the Hospital in Thimphu (the primary purpose of this trip) and will be teaching ham radio classes in the afternoon and evening. A testing session was planned near the end of January.

Glenn reported that over 25,000 A52A QSLs have been mailed, but that QSLing would be suspended while they are in Bhutan. All A52A QSLing was current as of early December and would be up to date prior to their departure on December 29. Other members of the Johnson family are Vivien, KL7YL; Melissa, NØMAJ; Paul, WØPRJ; and Carrie, NØCMJ. They all will obtain A5 callsigns when they arrive in Thimphu. QSL all of them via the WØGJ address.

Postage Rates and E-QSLs

I'm sure most of you know by now that the US Postal Service raised their rates effective January 7, 2001. The increase in the First Class rate from 33 to 34 cents was a modest one. This may not seem like much. However, there are other considerations.

Most of you use the mail regularly in requesting QSLs. A great many of those requests go to a U.S. QSL Manager, and you'll have to add one cent to your envelope gong and another one cent on the envelope coming back to you. Depending on your volume of QSLing, this could be a substantial amount of money over a period of time.

Now let's look at the rest of the world. Here is where these increased rates will hit hardest. For us in the U.S., we are faced with a *very* large increase in postal rates on international mail. For the 1/2 ounce envelope we used to mail for 60 cents, we will now be paying 80 cents. They did us a small favor, however, in that they eliminated that 1/2 ounce rate. Now you can mail up to 1

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full ounce for 80 cents. One ounce used to be $1.00. I must point out that *most* DXer mailings fell into that 1/2 ounce category, so you are going to be paying a full 33 1/3 percent more for most of your mail leaving the U.S.

For those of you who use IRCs rather than green stamps, you really get hurt. The rate was $1.05 from the post office, and it was increased to $1.75—an unbelievable 70% jump. Assuming that you usually put two IRCs in with your QSL request, you are looking at an increase in your total mailing to an international address of 80 cents for postage plus $3.50 for IRCs, for a total of $4.30. Compare this with the old total cost of 60 cents for postage plus $2.10 for IRCs, for a total of $2.70. This amounts to a 60% increase in mailing QSL requests from the U.S. to an overseas address.

I mention all of this to call attention to the subject of *e-QSLing*. We have all heard about *e-QSLs*, and there have been volumes written on the pros and cons of the subject. In early December the DX Reflector exploded with more on *e-QSLing* as a result of a DX station providing such a confirmation.

Ladies and gentlemen, *e-QSLs* will be great—once a system is produced that will allow it to be done in a safe and secure manner, a system that will allow all of us to be assured of the integrity of such a system. It must be such that an *e-QSL* can be received in such a manner that it *cannot* be altered by the recipient or anyone else.

As of this moment there is no system available. One does not simply go to RadioShack or your local computer software store and buy it off the shelf.

The WAZ Program

Single Band WAZ

150 Meter SSB

544 ..... N5ORT

20 Meter SSB

1069 ..... IK8WEJ
1070 ..... GWØSLM
1071 ..... W8KEN

17 Meter CW

29 ..... OH2DW

30 Meter CW

39 ..... SM6CST

40 Meter CW

213 ..... N9SF

160 Meters

24 endorsement, 35–40 zones AA4V
143 endorsement, 32 zones OK1DWC
127 endorsement, 37–40 zones ..... PAØCLN

All Band WAZ

SSB

4606 ..... KG8OU
4607 ..... JA5LEX
4608 ..... DL6ON
4609 ..... HL2KV
4610 ..... IK1HCG
4611 ..... IK7WUJ

Mixed

7988 ..... N2LYV
7989 ..... WA4AUL
7990 ..... WA4JUK
7991 ..... I1YDT
7992 ..... BA4TB
7993 ..... KK7BJ

All CW

210 ..... NN1D
211 ..... AI9L
212 ..... IK8YJQ
213 ..... F5JIW
214 ..... JH3FQY
215 ..... 4X/G3WUQ
216 ..... EA4BSC

RTTY

1243 ..... SM6CST
125 ..... W1VXV

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Paul Blumhardt, K5RT, 2805 Toler Road, Rowlett, TX 75089. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Paul Blumhardt. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. K5RT may also be reached via e-mail: <k5rt@cq-amateur-radio.com>.

5 Band WAZ

As of October 31, 2000, 543 stations have attained the 200 zone level and 1172 stations have attained the 150 zone level.

New recipients of 5 Band WAZ with all 200 zones confirmed:
S54E DF4PL

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)
W4LI, 199 (26)
K7UR, 199 (34)
WØPGI, 199 (26)
W2YY, 199 (26)
VE7AHA, 199 (34)
IK8BQE, 199 (31)
JA2IVK, 199 (34 on 40m)
ABØP, 199 (23)
KL7Y, 199 (34)
NN7X, 199 (34)
OE6MKG, 199 (31)
IK1AOD, 199 (1)
DF3CB, 199 (1)
F6CPO, 199 (1)
W3UR, 199 (23)
KC7V, 199 (34)
GM3YOR, 199 (31)
VO1FB, 199 (19)
KZ4V, 199 (26)
W6DN, 199 (17)
W6SR, 199 (37)
W3NO, 199 (26)
K4UTE, 199 (18)
K4PI, 199 (23)
HB9DDZ, 199 (31)
HB9BGV, 199 (31)
N3UN, 199 (18)
K4IQJ, 199 (23)
K3NW, 199 (23)
UA3AP, 199 (6)
OH2VZ, 199 (31)
K2UU, 199 (26)
W1FZ, 199 (26)
K9GX, 199 (26)
UT4UZ, 199 (6)
SM7BIP, 199 (31)
EA5BCX, 198 (27,39)
G3KDB, 198 (1,12)
KG9N, 198 (18,22)
KØSR, 198 (22,23)
UA4PO, 198 (1,2)
JA1DM, 198 (2,40)
9A5I, 198 (1,16)
K4ZW, 198 (18,23)
LA7FD, 198 (3,4)
K5PC, 198 (18,23)
VE3XO, 198 (23,23 on40)
K4CN, 198 (23,26)
KF2O, 198 (24,26)
W6BCQ, 198 (37,34on40)
G3KMQ, 198 (1, 27)
DL3JJ, 198 (19&31 on 10)
W5BOS, 198 (18,23)
N2QT, 198 (23,24)
OK1DWC, 198 (6,31)

The following have qualified for the basic 5 Band WAZ Award:

AI9L (152 zones)
AF9H (151 zones)
W4SD (172 zones)
W7SX (159 zones)
EA6BE (150 zones)
S50N (167 zones)
KZ2I (192 zones)

Endorsements:
SV1RK (200 zones)
OK1DWC (198 zones)
N3RK (160 zones)

****Please note: Cost of the 5 Band WAZ Plaque is $80 ($100 if airmail shipping is requested).**

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Paul Blumhardt, K5RT, 2805 Toler Road, Rowlett, TX 75089. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Paul Blumhardt. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. K5RT may also be reached at e-mail: <k5rt@cq-amateur-radio.com>.

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THE WPX HONOR ROLL

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with the CQ Master Prefix list. Scores are based on the current prefix total, regardless of an operator's all-time count. Honor Roll must be updated annually by addition to, or confirmation of, present total. If no up-date, files will be made inactive.

MIXED

4966.....9A2AA	3715.....N6JV	3269.....IT9QDS	2903.....KF2O	2753.....HAØIT	2289.....9A4W	1921.....DJ1YH	1611.....Z35M	1263...VE6BMX
4306.....W2FXA	3667.....9A2NA	3101...PAØSNG	2894.....W9HA	2745.....K0DEQ	2280.....W6OUL	1882...OZ1ACB	1576.....VE6BF	1209.....W2CF
4009.....F2YT	3629.....VE3XN	3101..WA8YTM	2852.....4N7ZZ	2721.....IK2ILH	2268....W8UMR	1872....JN3SAC	1444.....KØKG	1089..OK1DWC
4004.....K6JG	3563.....N4MM	3043.....K9BG	2835.....W2WC	2597.....HA5NK	2259.....K5UR	1852.....I2EAY	1430.....WT3W	1029.....KU6J
3976.....EA2IA	3537.....I2PJA	3042.....YU7SF	2825.....W2ME	2477..YU7GMN	2171.....W4UW	1756.....AA1KS	1410.....NG9L	1006.....VE9FX
3884.....W1CU	3472...SM3EVR	3033...YU7BCD	2814....JH8BOE	2454.....N6JM	2104.....W7OM	1686.....W7CB	1380.....N1KC	983.....KX1A
3772.....UA3FT	3374.....YU1AB	2994..WB2YQH	2799.....I2EOW	2381.....S58MU	2058..WB3DNA	1656....I1-21171	1347.....VE6FR	939.....N3KR
3748.....N4NO	3353.....N5JR	2974.....I2MQP	2789.....S53EO	2367.....W9IL	1946...PY2DBU	1618.....YU1ZD	1295.....W2EZ	

SSB

4333.....IØZV	2992....EA8AKN	2504.....4X6DK	2048.....HAØIT	1659.....K5IID	1549,....K8MDU	1320.....N2SS	1066.....NH6T	734.....VE6BMX
3879.....ZL3NS	2919.....N4NO	2492.....I8KCI	1969.....W4UW	1651.....W9IL	1538.....IKØEIM	1314.....KC6X	1046.....N1KC	719.....F5RRS
3703.....K6JG	2909.....I4CSP	2473.....UA3FT	1923.....K5UR	1634.....HA5NK	1518.....W2ME	1273.....NG9L	1015....DL8AAV	716.....KX1A
3527.....I2PJA	2893.....9A2NA	2422...WA8YTM	1876.....N6FX	1634.....K3IXD	1499.....DF7HX	1185.....KI7AO	982.....EA3EQT	707.....KU6J
3513.....F6DZU	2784.....N5JR	2358.....KF7RU	1787.....LU5DV	1628.....W7OM	1495.....IK2AEQ	1175....LU3HBO	972.....AI6Z	683....OK1DWC
3194.....CT4NH	2755.....I2MQP	2311.....CX6BZ	1774.....K2XF	1624.....I3ZSX	1479...SV3AQR	1156.....IKØJMS	937.....LU4DA	641.....F5LIW
3124.....N4MM	2708...PAØSNG	2230.....EA1JG	1752.....YU7SF	1609.....W6OUL	1432.....N3XX	1155.....K4CN	892.....AG4W	635.....F5UTE
3085.....EA2IA	2654....CT1AHU	2183...YU7BCD	1712.....I8LEL	1606.....DK5WQ	1423.....W2FKF	1121.....WT3W	878.....JN3SAC	608.....KE4SCY
3027.....OZ5EV	2600.....I2EOW	2134.....IN3QCI	1704.....EA7TV	1582.....IT9SVJ	1411.....T30JH	1104....EA5DCL	862.....VE9FX	
3019.....F2VX	2515....LU8ESU	2061....OE2EGL	1668.....KS4S	1572..CT1BWW	1386.....I3UBL	1073.....I2EAY	790.....N3DRO	

CW

4063...WA2HZR	2709.....LZ1XL	2399..WA8YTM	2026.....G3VQO	1782.....IT9VDQ	1558.....I2EAY	1467.....EA6AA	1157.....DF6SW	799.....WT3W
3708.....N6JV	2593.....VE7DP	2302.....W2WC	2022.....N6FX	1744.....W6OUL	1553...EA7AAW	1348.....LU3DSI	1155....LU7EAR	739....WA2VQV
3366...VE7CNE	2578.....9A2NA	2243....JA9CWJ	2004.....G4SSH	1712....JN3SAC	1549.....W7OM	1270.....4X6DK	1063.....W4UW	736.....AI9L
3229.....K6JG	2535.....W2ME	2173.....HAØIT	1926.....OZ5UR	1678.....IK3GER	1509.....EA5YU	1265.....EA2CIN	995.....YU1TR	691.....N1KC
3175.....N4NO	2522.....N4MM	2164.....KA7T	1853.....I7PXV	1670.....N3XX	1509.....W9IL	1245.....I2MQP	994.....K2LUQ	670.....KU6J
3108.....K9QVB	2490.....N5JR	2147.....HA5NK	1842.....LU2YA	1668.....9A2HF	1492.....VE6BF	1240.....AC5K	930.....PY4WS	623.....KX1A
3050.....YU7LS	2450...YU7BCD	2083.....S58MU	1823.....K2XF	1658.....DJ1YH	1487.....9A3SM	1174.....KC6X	904.....JK1AJX	614.....F5RRS
3076.....EA2IA	2445.....G4UOL	2057.....KF2O	1822.....K5UR	1564....JA1GTF	1482.....IK5TSS	1161.....I2EOW	888.....VE6BMX	610.....EA5DCL

"Salt," 9M6ST, lives on Labuan Island (IOTA OC-133), a few kilometers west of Borneo. He favors 20 meters SSB 1500–1700Z on weekends and the SEANETon 14320 at 1200Z.

Charlie, K4VUD (seated), and Jani, YBØUS (standing behind Charlie), during the welcome reception of the W9DXCC Convention in September 2000. Charlie gave a slide presentation on Bhutan sites from his previous visit. Charlie and Jani operated from Bhutan in December as A52UD and A52AP. (Photo courtesy W9MU and W9VA)

The ARRL has been studying this problem for some time. They have spent a substantial amount of *our* money to investigate the feasibility of providing such a system. It must be a system in which we all can believe, a system that will provide the integrity that must be there if the DXCC program is to continue to provide the ultimate DX award.

I hear that the ARRL probably will have a system ready to test by late next year. Let's give them the time required to make it right. Your patience and support for such a system will go a long way toward making it possible at the earliest date. Until we can have a working *e-QSL* system, we'll just have to pay the price for the USPS.

Books

Language: Ever hear a DX station you really want to work but there seems to be a language barrier? In researching a request for a book called *The Radio Amateur's Conversation Guide,* I found some useful information I'll share with you. Jukka, OH2BR, and his brother OH2BAD created this book in 1980. It is a spiral-bound booklet containing 147 phrases and a 450-word dictionary in eight widespread languages (English, German, French, Italian, Spanish, Portuguese, Russian [phonetic version],

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Franz, DJ9ZB, at the operating position of J5Z/J5X last year. (Photo courtesy Franz, DJ9ZB)

and Japanese). There are also five supplements in OH, OZ, PA, SM, and YU/9A containing the same text as in the book. In addition, there are also C-cassettes containing the 147 phrases in 8 versions read by a native speaker (CT, F, G, JA, OH, SM, UA and W). Jukka told me late in 2000 that the majority of the "stock" had been destroyed accidentally. However, a very limited number of the book, supplements, and cassettes are still available. If you are interested, contact Jukka, OH2BR (e-mail <oh2br@kolumbus.fi>) or by mail at his callbook address for further details.

Propagation: Another book of interest, primarily for low band enthusiasts, is an updated edition of *Long Path Propagation, Revisited in Year 2000* by Bob Brown, NM7M. This is an update to his earlier book, *Long Path Propagation* written almost ten years ago. The update expands the original discussion, a year-long study on 20 CW, to include new information on long-path propagation and the other bands, 10 to 160 meters. It consists of ten chapters, 91 pages, and 67 figures and should be of interest to DXers, new and old. The price is $15 US for both foreign and domestic DXers, as all shipping and handling is included in the price. Contact Bob Brown, 1105 27th Street, Room AW-110, Anacortes, WA 98221-2710 USA, or by e-mail: <bobnm7m@cnw.com>. Bob says, "Please note that all proceeds beyond the cost of printing and mailing will be donated to my favorite charity, "The Handi-Ham System of the Courage Foundation in Minneapolis, Minnesota."

And Finally . . .

The contest season is not over yet. We still have a number of major events to be run. Here's hoping that everything holds together for you—equipment, antennas, etc.—and you have a great time and work lots of good DX.

73, Carl, N4AA

CQ DX Awards Program

SSB

2322	UA9LM	2325	KA5AGM
2323	IZ1ANU	2324	K3MI

SSB Endorsements

320	W7OM/333	320	N2VW/329
320	IK8CNT/333	320	VE2GHZ/329
320	N7BK/333	320	KF8UN/328
320	VK4LC/333	320	W2FKF/326
320	K7JS/333	320	N3RX/321
320	YU1AB/333	310	WA4ZZ/312
320	W4UNP/333	310	WZ3E/311
320	WØYDB/332	275	KE4SCY/291
320	I8KCI/332	275	N5WYR/281
320	WB4UBD/332	250	WA5MLT/250
320	OE2EGL/332	250	K4IE/250
320	WB3DNA/332	150	KD2GC/150
320	K9PP/331	OSCAR	VR2XMT
320	WA4WTG/329		

CW Endorsements

320	F3TH/333	320	W1WAI/331
320	W4OEL/333	320	WB4UBD/328
320	WB5MTV/333	320	N5HB/325
320	WØHZ/332	320	YU1AB/325
320	W7OM/332	320	K7JS/321
320	K4CEB/332	300	KF8UN/308
320	W7CNL/332	320	WA7SNY/200

RTTY Endorsements

320	WB4UBD/325	275	W4EEU/291

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business-size, No. 10, self-addressed, stamped envelope to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. Currently we recognize 333 active countries. Please make all checks payable to the award manager.

QSL INFORMATION

1B1/OE5GML to OE5GML
3A2K to 3A2ARM
3C2JJ to F2XX
3D2QB to SM3CER
3D2RK to W7TSQ
3D2RW to ZL1AMO
3D2SQ to W7TSQ
3D2ZC to AA1ON
3DAØCF to K5LBU
3DAØEW to K5LBU
3W2KYU to JH8KYU
3W2LC to VK6LC
3W6KM to ES1AKM
3W7CW to SP5AUC
3W7TK to OK1HWB
3XY2D to VE2DPS
3ZØEMC to SP6ECA
3Z3JPL to SP3PDV
3Z6ØW to SP2BNJ
3Z6IEQ to SP6IEQ
4B1AC to XE1BEF
4F7/SM3SGP to SM3EVR
4K1F to UT5UGR
4L26MAY to 4L1DA
4L4KW to KE1HZ
4L4MM to ON4CFI
4O8/9XØA to RW3AH
4S7BRG to HB9BRM
4S7UB to KJ6UB
4S7YSG to JA2BDR
4W/K7BV to KU9C
4WØAI to CT1EGH
4W6GH to CT1EGH
5C8A to EA5XX
5C8M to DL6FBL
5H3US to WA8JOC
5I3A to A47RS
5I3B to A47RS
5N4BFD to DJ9FH
5R8DS to PA3BXC
5R8FL to F5TBA
5V7MD to K7PT
5X1Z to SM6CAS
6Y5MM to W4YCZ
6Y8A to WA4WTG
7A5DX to YBØAI
7P8AA to DL7VRO
7Q7TB to G3TBK
7S2A to SM2LWU
7S2E to SM2DMU
8J7WGC to JARL
8M2ØØØ to JARL
8P9JL to OH6RX
8P9V to OH6RX
8Q7KK to HA2SX
8S7A to W3HNK
8S7IPA to OZ5AAH
9E1C to IV3OWC
9G5ZW to OM3LZ
9J2FR to IK2RZQ
9K2SS to KB2MS
9M2TO to JAØDMV
9M2XA to JF4WPQ
9M6CT to G4JMB
9M8QQ to DF5UG
9N1AC to N3ME
9N1VJ to JA9VJ
9N7IP to JG5CIP
9N7VN to K3VN
9V1XE to DL4DBR
A35MQ to DL8NBE
A45ZN to GØDBX
A52A to WØGJ
A52NL to JA6NL
A61AO to N1DG
A61AT to IT9ZGY
AJ2U/VP9 to KQ3F
BTØQGL to KQ6PS
BV9G to BV8BC
BX4AL to W3HC
C21JH to VK2GJH
C6AKA to DL7VOG
C6DX to W8GEX
CN8LI to ON4ANT
CN8WW to DL6FBL
CO8LY to EA7ADH
CO8TW to EA3FQV
CT3KN to CS3MAD
CT9KN to CT3KN
CV7V to CX4ACR
CW6V to W3HNK
D3SAF to I3LLH
D68TA to JA1IDY
DN1VA to DJ9VA
ED1ONS to EC1BXI
ED5SJF to EA5URL
EMØHQ to UX2MM
EM3J to KG6AR
EM7ØDXG to UT1WA
EN5J to KG6AR
EO55FI to UX3FW
EO55HK to UT1HT
EO55IX to UR6IM
EO55JM to KG6AR
EO55ZN to UYØZG
EP1DX to DL1EL
EP2AC to RV6AB
ER4DX to UT7ND
ER6A to ER1LW
EY8MM to K1BV
EZ3A to EZ8CW
F5KEE/FY to F8BXI
FK8HW to VK4FW
FOØDER to 3D2AG
FOØMOT to OM2SA
FOØPT to DJØFX
FOØSPE to KG6AR
FO8DX to KG6AR
FP5DX to TK5NN
FW/G4DZC to AA1ON
FY/F5KEE to F8BXI
GDØKRL to GØKRL
GM2T to GMØALS
GS3EEO/P to G3OCA
GUØVJG to GØVJG
H4ØMY to JAØIXW
HC4WW to UA4WAE
HI3/YT1CS to YZ1GD
HL2ØOO to HL5AP
HO3A to HP3XUG
HSØ/G4DZC to AA1ON
HSØZAC to KO6H
HSØZCP to KS7K
IH9/OL5Y to OK1MG
IRØAD to IØNNY
IR3BZ to IN3DEI
J27JUIN to F5IPW
J28EW to F5LDY
J28NH to F5IPW
J37K to W8KKF
J43O to SV3AQR
J68AK to W8QID
J68AM to W8ILC
J68DD to N6JRL
J68TD to KD4YHY
J75KG to N2AU
JT1FCX to K4ZLE
JT1FCY to I1QOD
JT1FCZ to I1ZB
JT1Y to IØSNY
JU1O to HAØHW
JU1Y to IØSNY
JW5LJA to LA5LJA
JW7M to LA7M
JY8TT to 4X6TT
JY9QJ to DL5MBY
K5K to **K4TSJ**
K1HP/KHØ to JE2EHP
KHØ/AH6PW to JN1HOW
KHØAS to WB4UBD
KH2/K4ANA to W2PS
KH5/KA4IST to AC7DX
KH6ND/KH5 to K4TSJ
KL7USI to KL7JR
KP2/AG8L to NN6C
KP2/K4IIF to KG6AR
KR6IG to K5YG

(The table of QSL Managers is courtesy of John Shelton, K1XN, editor of "The Go List," P.O. Box 3071, Paris, TN 38242; phone 901-641-0109; e-mail: <golist@wk.net>.)

Contesting

BY JOHN DORR, K1AR

News/Views Of On-The-Air Competition

The Escalating Packet Revolution

February's Contest Tip of the Month

In the spirit of this month's editorial topic, never trust what you see on your packet spotting screen. In recent years, busted calls have been rampant. A quick QSO that does not equate to taking the time to copy the callsign is a sure-fire way to get your score reduced. Also, to be blunt—it's just not right! Make sure, under any circumstance (including packet use), that what you put in your log is what you've worked. No antenna farm can make up for log accuracy.

Calendar of Events

Jan. 26-28	**CQ WW 160M CW Contest**
Jan. 27-28	REF CW Contest
Jan. 27-28	UBA SSB Contest
Feb. 3-4	Vermont QSO Party
Feb. 4	N. American SSB Sprint Contest
Feb. 4-5	Classic Radio Exchange
Feb. 10-11	World-Wide RTTY WPX Contest
Feb. 10-11	Dutch PACC Contest
Feb. 17-18	ARRL CW DX Contest
Feb. 23-24	**CQ 160M SSB Contest**
Feb. 24-25	REF SSB Contest
Feb. 24-25	UBA DX CW Contest
Mar. 3-4	ARRL SSB DX Contest
Mar. 10-11	RSGB Commonwealth CW
Mar. 17-18	Bermuda Contest
Mar. 17-18	Russian DX Contest
Mar. 17-19	BARTG Spring RTTY Contest
Mar. 17-19	Virginia QSO Party
Mar. 25-27	**CQ WW WPX SSB Contest**

Hams, and contesters in particular, have always been known as innovators in communications technology. Packet radio and its application to DX spotting and communications is great proof point of this claim. This month I'd like to draw your attention to packet's impact on contesting. Has it all been positive? Where is it heading? Should contest sponsors take pre-emptive steps? These are the questions we should be thinking about.

In considering this month's topic, I was reminded of the recent announcements of escalating baseball player salaries. Contract terms such as $140 million for 8 years and $240 million for 10 years with $13 million signing bonuses boggle the mind. In essence, Major League Baseball compensation has grown completely out of control. The question to consider is, has lack of control taken place with respect to packet spotting and contesting?

Packet radio applications began in the early days as an innovative way to allow multiple users to connect to a centralized "node" for messaging and transmission of data traffic. When Dick Newell, AK1A, came on the scene, he had a vision that this could be extended as a tool to notify users of DX operation(s) on the bands. In its infancy, the tool was very rustic, to say the least. I recall many times when Dick would put his node on the air and I would spend evenings with him trying to "break it." Much to Dick's chagrin, I was often successful. However, that success quickly translated into proliferation of the concept. Once node providers figured out a way to fund the technology, the availability of PacketCluster™ became nearly ubiquitous in ham radio. In fact, there are well over 1000 packet spotting nodes around the world as we speak.

Since those early days, the advent of the internet has created more access to packet, as you can now TELNET your way into hundreds of packet nodes around the world without even owning a radio. This rapid growth has led to widespread adoption by tens of thousands of users in hundreds of countries around the world. To say that the cat is out of the bag is a huge understatement.

Well, I think we all can identify the benefits that have come from this revolution, so I'm not going to spend much time on that area this month. It, of course, ranges from newfound enthusiasm for DXing and contesting in general to increased use of computers in ham radio, and those are factors that can't be ignored.

However, there has been a flourishing downside from packet usage and a significant one at that. Some of you may view this as taking the half-empty-glass approach to the debate, but I prefer to describe it as calling a spade a spade in this case. Here are some of the realities:

• Packet radio spotting has had a very negative impact on contesters using their own basic operating skills. In many cases we've become lazy by becoming dependent on what shows up on our computer screen at the expense of good old-fashioned tuning.

• Logging inaccuracies abound as operators simply enter the callsign on the screen rather than actually copying the ID of the station they are working. (See this month's contest tip for more on this one.)

• Some of us have become so dependent on packet spotting that we won't even bother to enter a contest if we temporarily "lose our connection." It's as if there's an emerging need for Packet Spotting Anonymous!

• A new opportunity for cheating has surfaced, as packet radio monitoring by single operators became possible. In fact, there's a disturbing trend by some who advocate the use of packet by single operators in operating events to be acceptable as long as it's outside of the main contests, and especially if it's a part-time operation or if the score is "non-competitive."

• If you've ever been on the DX end of a contest (or represent a rare contest multiplier), you are all too familiar with the concept of a packet pile-up. With packet radio, we move around in herds from one DX spot to the next, creating havoc, especially for the casual and/or inexperienced operator on the other end who wonders what happened as his pile-up grew from two stations to dozens in a matter of seconds.

When considering the factors I've outlined above (and others), some very strong opinions of many high-profile contesters exist. There is a growing movement that says packet spotting should be *totally* eliminated in contesting. The view is that the benefits are significantly overshadowed by the negative factors. Even if you buy into that argument, as stated above, there's just too much momentum and acceptance of packet use by mainstream contesting to make that bold a move. After all, this is not the 1920s, where prohibition was decreed. Also, just as prohibition would not work in the 21st century, neither would the elimination of packet radio at this point.

What should we do? Peer pressure has always been our best tool in improving contesting operation. Here are some suggestions:

• The rules are clear on packet use. If you're a single operator, be a single operator—period! There should be no

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e-mail: <K1AR@contesting.com>

exception for any contest. Anything else is unfair and wrong. If you suspect someone has violated this rule, challenge him or her on it.

• Take pride in your logging accuracy by not falling into the trap of logging the bad copying of others which appears in the packet scheme.

• Don't become one of those obnoxious, endless callers in packet pile-ups (We're all guilty of this one.).

• Be a contributor to packet spotting as opposed to mostly a consumer. Never let your tuning skills become a lethargic part of your operating portfolio.

Well, there's certainly more that can be said on the topic, and I'm certain I'll get some mail on this column. As always, your comments and thoughts are welcome!

A Final Tribute to Steve Affens, K3SA

Some of you may have heard of the untimely passing of one of contesting's silent contributors, Steve Affens, K3SA. Steve was an old friend of those of us at *CQ,* having offered generous amounts of time and skill in assembling the *CQ Contest* magazine website. More important, he was an unabashed supporter of contesting in general, who offered infectious enthusiasm for contesting to anyone who knew him.

Steve suffered a heart attack while diving on Grand Cayman the day after the 2000 CQ WW CW Contest. He was vacationing with his family for his 30th wedding anniversary, having worked the contest as ZF2SA. Steve was Potomac Valley Radio Club's club webmaster and historian and had just upgraded his home station with a new set of Force 12 antennas (tnx N3OC).

The best tribute that we can provide for our friend is publishing his "soapbox" from his last contest. Here is the 2000 CQ WW CW Contest in Steve's own words. Rest in peace, old friend.

The last radio contest trip for me was 20 years ago as K3SA/PJ3. It was paper logs with dupe papers for each band strewn about the floor. Little did I know how popular Aruba would become for contesters and that computer logging would change the experience forever.

My biggest mistake from 20 years ago was age. Take my advice: Do it now if you can. I'm now too old to stay in the chair 48 hours (not that I ever could). I'll take a couple of good sleep nights, thank you. Also, I arrived the day before the contest. I have concluded that it is cutting it too close considering airline, antenna, RFI, rig, software, and computer issues that crop up.

Hanging two dipole systems end-to-end across a parking lot was far more arduous and time consuming than expected and required every tool I brought, including the sling-shot system. For some reason, palm trees will not let parachute rope slide through easily. The rope binds in the top of the tree. It is also harder to keep those multi-band dipole wires from wrapping over themselves over the top of each other than one might think. When the rope catches, the system jerks and the 15 and 10 dipole wires inevitably wrap over the top of the 20 meter wire and the system has to be tweaked again.

I needed the wire system especially for the low bands. Believe it or not, the Spider mobile antenna system was very competitive with the full-size dipoles. With a ZF call, the action off the four-story high Spider was 250/hour at times. It was fun to run into friends, especially because normally I enjoy the packet connection to the news of the bands.

I enjoyed working W3LPL on all bands. Missing packet dropped the multiplier count significantly, but the point was to play it like Sweepstakes and just run, run, run, letting the mults come as they chose. When they did, it was, in a way, more of a thrill. When a run consists mostly of US stations, it knocks you out of the chair when a 9M8 or A61 calls through the pile. VKs, ZLs, JAs are still awesome when they roll in over the Caribbean.

With only 100 watts and wires, it was hard to run Europe through the Ws during the morning hours. Starting around noon local time (1700Z) the sequence starts: First the East Coast US loses EU and the band clears out to the point where a Caribbean station stands out and the runs really pick up. Then, the same thing happens on 15 and down to 20 and to 40 as the world rotates us all into darkness. One benefit of aging is having the experience and knowledge to follow the band sequence for best run results. A few more trips and I might even get good at it.

The bands were wonderful as a consequence of the peaking sunspot cycle, but we paid the price on Sunday around 1640Z. A huge solar flare blew out the bands entirely. I thought my antennas had been hit by a truck or bird or something. But soon signals started to return, first on 10 with some big contest stations sharing their observations and lamenting the potential loss of QSO count goals. It took an hour for the bands to recover, starting with 10, and the recovery sequenced down in frequency over that time. It sure was scary and initially disappointing. I got up and went poolside for lunch with Patty (a "no-no" if the US runs are about to begin). This was our 30th anniversary trip, so what's a few hundred QSOs anyway?

Thanks all for the QSOs and I will QSL via W3HNK.—73 de Steve, ZF2SA (K3SA op.).

Final Comments

Well, that's all for this month's edition. As some of you may be thinking, it's becoming that time of the year to run another *CQ* Contest Survey. Keep an eye out for the year 2001 edition over the next month or two.

73, John, K1AR

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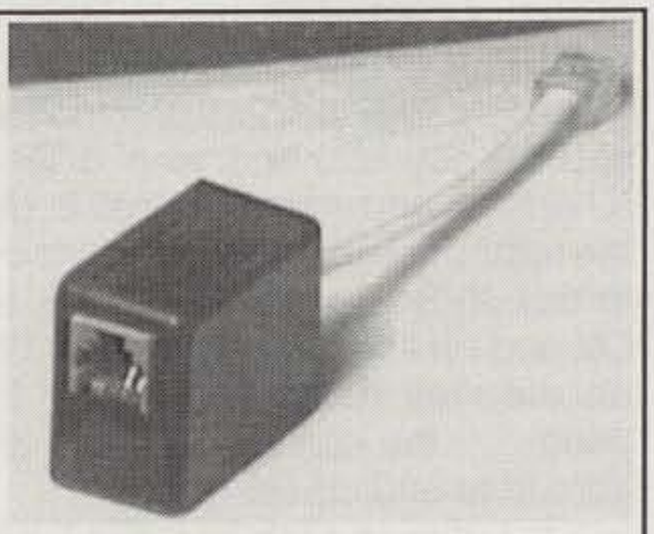

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Awards

BY TED MELINOSKY, K1BV

News Of Certificate And Award Collecting

This month we highlight Donald Kimble, AE3Z, USA-CA All Counties #1009, who worked his last one on September 6, 2000. He tells us his story:

"My experience with the County Hunter Net started many years before I became a county hunter. I remember back in the late 1960s and early '70s when I was 'maritime mobile' (US Navy). We used to prowl the bands looking for someone who might run a phone patch for us to the States. Many times we would come across the CH net or the YL net (and others) and ask if anyone would run us a patch. Most of the time we could make a contact on the Maritime Mobile Service net, but during the real bad times of the sunspot cycles we took whatever we could get.

"Even though I used to listen a lot on the CH net, I never really did 'collect' counties because being underway on a Navy ship most of the time, it just wasn't feasible to get involved. Over the years I'd run by the CH net for the heck of it and maybe work a station or two.

"I always had an HF mobile rig in my vehicles until I retired from the Navy in 1978. Even after that we would put one in if we were going on a trip. I guess HF mobile was 'my thing,' because I always told everyone how much fun it was and that it was what I likedmost about ham radio. But with the 'size' of the new vehicles coming out, it became more and more difficult to find room enough for those humongous radios, and I kind of gave it up.

"Every time we ran into Elwood, KA3MMM, he would tell us about his experiences and how many counties he had worked. It sounded kind of silly actually, but everyone used ham radio for lots of different things. Who could ever work all 3076 counties anyway?!

"In July 1997 a friend of mine told me about a guy who had 'won' a TS-50 at a hamfest and wanted to sell it. (At half the retail price it wasn't difficult to decide to buy it!) So we went 'mobiling' again. Off and on I would listen to the CH net on the way home from work. Funny thing . . . the dial on the radio always semed to end up on 14.336!

"One day in October 1997 K6SRK was running Mineral, Colorado. I picked up the mic and called him. That was it.

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e-mail: <k1bv@cq-amateur-radio.com>

USA-CA Special Honor Roll

Terry Holman, AC4PY
USA-CA All Counties #1012
November 22, 2000

USA-CA Honor Roll

500		2000	
AA8RU	3131	N9JLT	1200
AC4PY	3132	AC4PY	1201
1000		**2500**	
W4TYU	1560	AC4PY	1126
AC4PY	1561		
1500		**3000**	
N9JLT	1300	AC4PY	1031
AC4PY	1501		

The total number of counties for credit for the United States of America Counties Award is 3076. The basic award fee for subscribers is $6.00. For nonsubscribers it is $12.00. To qualify for the special subscriber rate, please send a recent CQ mailing label with your application. Initial application may be submitted in the USA-CA Record Book, which may be obtained from CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801 USA for $2.50, or by a PC-printed computer listing which is in alphabetical order by state and county within the state. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated June 1, 2000. A complete copy of the rules may be obtained by sending an SASE to Ted Melinosky, K1BV, 65 Glebe Road, Spofford, NH 03462-4411 USA. DX stations must include extra postage for airmail reply.

I was hooked! The day after Thanksgiving all the kids had left, and Marilyn and I decided to try our luck at 'running' counties. Off we went. Of course, no one knew who the heck we were, but that didn't matter. We were having too much fun. Both of us love to travel, and running counties certainly gave us a chance to do that.

"I finally worked the last one I needed on September 6, 2000 when Joe, WBØCQO, made a trip to Chickasaw County, Iowa. Frankly, I never figured that I would get there. It is quite interesting, to say the least.

"There are so many people to thank for all the counties that it would be difficult to list them all. First of all, I have to thank Elwood, KA3MMM, for his persistence, which keyed me in to county hunting. Then there is Pete, K4QFK, who drove many, many miles out of his way just to run the 'next to last' for the whole thing and for someone else who was going to get 'the last one for the whole ball.' I thought that was an incredible thing to do and I really appreciated it a lot. I'd also like to thank Don, KC2XZ, and John, WA2FJM, who took their time to help me with the final check and signed my book. Last, we couldn't do this without all the great folks out there spending their time and money to run these counties for us to work. To all the mobiles who helped me get to this point, a big Bravo Zulu for a fine job.

"Of course, most of all I have to thank my lovely wife and best friend Marilyn for putting up with this foolishness over the past 30-plus years.

"Here we go again! Second time coming up!" —*AE3Z*

More USA-CA Questions

Q: Some state QSO parties do not require exchanging signal reports. Are QSL confirmations from these contests valid towards USA-CA?

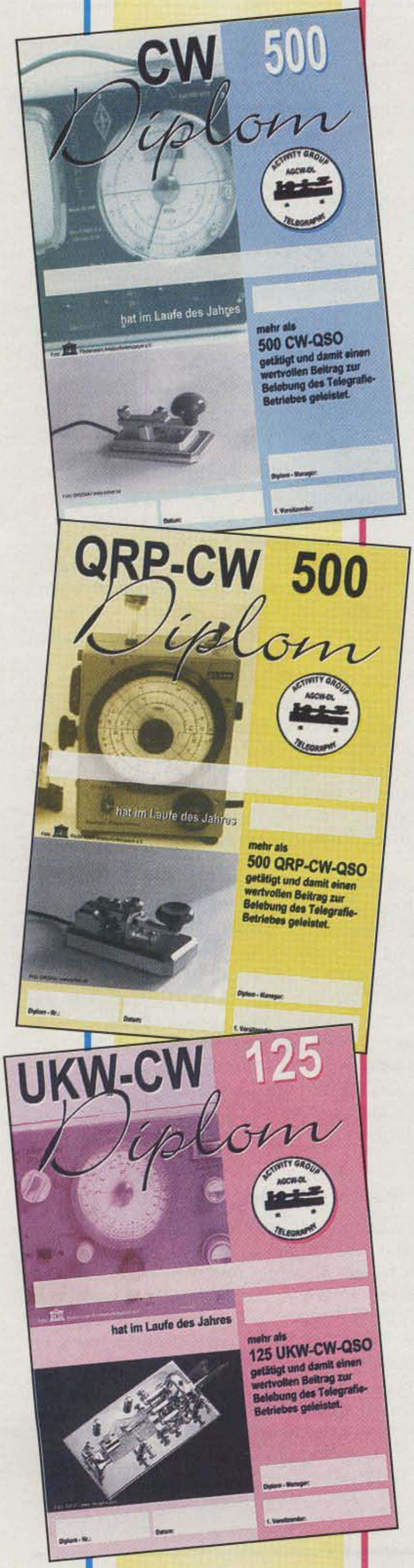
A: Interestingly, the rules for USA-CA do not mention signal reports, nor does the official record book contain a column to show them. The idea behind USA-CA is to prove a contact with the counties, and a contact requires at least a minimum amount of informaton be transferred between the two parties. Any cards you receive from these QSO parties or contests is proof that you contacted that station and exchanged some meaningful information. Yes, these contacts and cards are valid for the award.

Q: I live within the city limits of Manassas, Virginia. Several of my friends have said that Manassas City counts separately from Prince William County, which surrounds the city. When passing out my exchange in a contest, do I give out my county or Manassas City?

A: Virginia is one of only a few states which have "independent cities" which are not part of any county. It's a constant source of confusion, but here goes: For USA-CA purposes, since you are entirely surrounded by Prince William County, the only county you are "good for" is Prince William. If the official City of Manassas borders touched two or more other counties, you couldn't tell the other person what county you were in, but you could inform them that your contact could count for either of the two counties. The station that works you gets to choose—just one time—the county you are good for. They can't work you again on another band and count you for the other county.

DX Awards

AGCW-DL Award Series. Felix Reiss, DL5XL, is the chairman of the AGCW-



Samples of the AGCW-DL series of awards. The group was founded to promote CW activities on the ham bands.

DL group in Germany. AGCW is an abbreviation for Activity Group Telegraphy, which is Germany's largest CW special-interest group, with more than 1500 German members plus about 500 members in other countries. Their awards program has been around since the early 1970s, but they've recently created new designs that emphasize their CW and QRP interests. If you look at your DL QSL card collection, you will notice many of them show an AGCW-DL membership number. You already may be well on your way towards earning their award for working members.

The group sponsors contests and publishes a very large newsletter in the German language. Information about joining the AGCW-DL group can be obtained from Lutz Schroeer, DL3BZZ, Am Niederfeld 6, D-35066 Frankenberg, Germany.

General Requirements: This group was founded to promote CW activities on amateur radio bands. Contacts after 1 January 1971, the date of their founding. SWL okay. GCR is accepted. Write if interested in joining the organization. Fee for CW-QRP-100 is DM6, or $US5; for W-AGCW-M it is DM15, or $US10; and for all the others DM10, or $US7. Endorsement for the long-term award is DM2.50, or $US2 each. Apply to: Tom Roll, DL2NBY, Postfach 568, D-91774 Weisenburg, Germany.

A membership list is available on request from the sponsor. Please provide an SASE.

CW 2000, CW 1000, and CW 500: Make 2000, 1000, or 500 CW contacts within one calendar year. All HF CW contacts are eligible, including contests. AGCW members should submit a declaration stating the exact number of QSOs claimed. Non-members should submit a list containing the QSOs on a monthly basis.

QRP CW 500, QRP CW 250, and QRP CW 100: As above for contacts on CW, but using an input of 10 watts or less or output of 5 watts or less. The application for this award should contain the declaration "I declare that for the QSOs listed, the input did not exceed 10 watts or the RF output did not exceed 5 watts." All other conditions as above.

VHF CW 250 and VHF CW 125: As above, but for CW contacts on VHF bands (144 Mhz or above) only. A total

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The Yamato Club Award is a parchment-style certificate which should definitely be an attention-getter.

of 250/125 CW V in a calendar year is required. Any legal power input.

W-AGCW-M: Contact AGCW members. Bronze level—at least 200 points are needed for this award; Silver 300 points; Golden 500 points. QSOs with members count 1 point each; with YLs/ XYLs 3 points. Non-DL European stations multiply their total points by 2; DX by 3. VHF/UHF contacts count double. A station may only be worked once.

AGCW Trophy: Any licensed amateur or SWL may apply for a fee of $10US, or DM20, and proof of eligibility. This requires a list showing at least six CW awards and participation in at least three different CW contests (must place among first ten in each). At least one award and one contest must be AGCW. All awards and contests must be after 1 January 1971. For this special trophy, applications must be addressed to: Gunther Nierbauer, DJ2XP, Illinger Strasse 74, D-66564 Ottweiler, Germany.

Yamato Club Award. Thanks to Shoji Nishiyama, JJ1JG, for the sample of the Yamato Club Award. This is a 10" × 14" leather-textured, brown parchment certificate which depicts the old Japanese style of handwriting using a large brush. A translation of the writing is "Yamato is a marvelous zone in Japan." This will be an attention-getter on your wall!

The "JCC" means Japanese Century City and is associated with the JARL award of that name. If you look at your Japanese cards, many have imprinted somewhere on them either the city or gun code. The city is a four-digit number, and the gun (a smaller administrative unit) is a five-digit number. The first two digits for each stand for the Prefecture, similar to a county. Eleven (11) stands for Kanagawa Prefecture. Thus, Yokohama, an important city in Kanagawa prefecture, is JCC 1101.

Work Yamato City and neighboring cities of Yokohama, Sagamihara, Machida, Zama, Ebina, Ayase, and Fujisawa. JAs need ten cards—three from Yamato City and seven from the neighboring cities. DX stations need five cards, including one from Yamato City and at least four of the neighboring cities, which include Yokohama (JCC 1101), Sagamihara (1110), Machida (1010), Zama (1117), Ebina (1116), Ayase (1119), and Fujisawa (1106). No time limitation. A JA1ZEK card may be used as a substitute for any one missing city. SWL okay. Send GCR list and 500 Yen, 7 IRCs or $US4 to: Syoji Nishiyama, JJ1JGI, 3619-14, Fukuda, Yamato, Kanagawa 242, Japan.

Internet Site of the Month and...

France's REF web site contains a very handsome and complete section on the many awards of this national organization. This may be found at: <http://www.ref63.inetech.fr/diplomes/francais/Reglements/index.htm>. The text is in French, but if you cut and paste to one of the internet free translator services, such as Babelfish (<http://babelfish.altavista.com/translate.dyn>), a reasonable translation may be had in just a few seconds.

Finally, we're always on the lookout for the awards of your club or group. Send samples and complete information to me at the address at the beginning of this column so we can help you publicize your program.

73, Ted, K1BV

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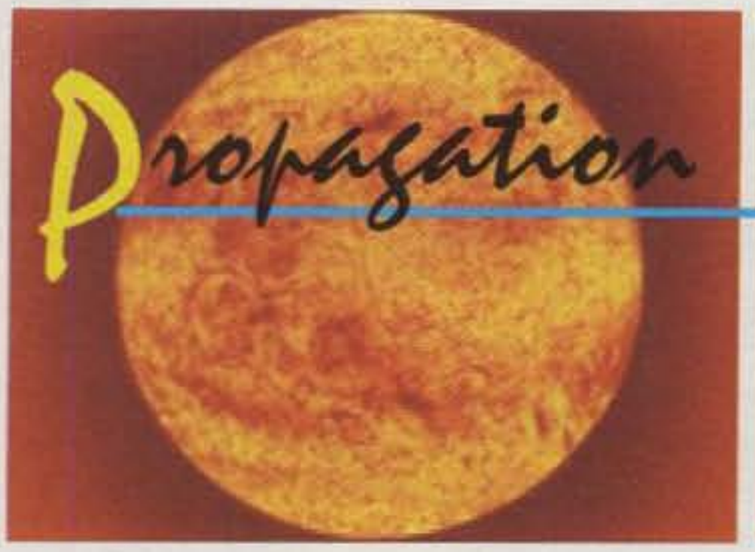

Propagation

BY GEORGE JACOBS, W3ASK

The Science Of Predicting Radio Conditions

Flash: Good CQ WW DX CW Contest Weekend!

Conditions during the 2000 CQ World-Wide DX CW Contest weekend of November 25–26 2000 were much as predicted. Conditions on the first day and until 12 UT on the 26th were almost as good as the "wow" record-breaking conditions observed during the 1999 contest weekend. Expected geomagnetic and ionospheric instability began about 12 UT on the 26th and developed into a minor radio storm by 18 UT. During the final hours of the contest conditions were somewhat degraded on all bands, especially for openings passing through the polar and auroral zones regions.

Overall geomagnetic, solar, and ionospheric data, as well as initial reports from contestants, appear to confirm a generally good CW contest weekend on all bands, with the possibility of near - record scores this year.

A solar anomaly was observed during the contest weekend. The 10.7 cm solar flux level reached high levels of 201 on November 25th and 202 on the 26th. These were considerably higher than the levels observed during the record-breaking 1999 CW contest weekend. On the other hand, the telescopic daily sunspot counts were relatively low, 74 and 59, respectively. These were almost half the levels observed during the 1999 contest!

Radio flux measurements are considerably more accurate a measurement of solar radiation than is the sunspot count. However, sunspot count data continue to be collected because there is an unbroken archive of such data for more than 250 years. Solar-flux measurements are available for a period of little more than 50 years.

Key geomagnetic, solar, and ionospheric data recorded during the CW contest weekend are summarized in Table I. Table II shows the level of geomagnetic activity taken every three hours during the contest weekend as measured by the Kp worldwide, or planetary, index.

11307 Clara Street, Silver Spring, MD 20902
e-mail: <george@gjainc.com>

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for February 2001

Propagation Index.....	Expected Signal Quality (4)	(3)	(2)	(1)
Above Normal: 2-3, 20, 22	A	A	B	C
High Normal: 4-6, 10-12, 19, 21, 24	A	B	C	C-D
Low Normal: 1, 7-9, 13-14, 18 23, 26, 28	B	C-B	C-D	D-E
Below Normal: 15-16, 25, 27	C	C-D	D-E	E
Disturbed: 17 C-D	D	E	E	

Where expected signal quality is:

A—Excellent opening, exceptionally strong, steady signals greater than S9.

B—Good opening, moderately strong signals varying between S6 and S9+, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S6, with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. Find the *propagation index* associated with the particular path opening from the Propagation Charts appearing on the following pages.

2. With the *propagation index*, use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a *propagation index* of 3 will be fair to good (C-B) on feb. 1st, excellent (A) on the 2nd and 3rd, good (B) on the 4th to 6th, fair-to-good (C-B) on the 7th to 9th, etc.

Sunspot Cycle Progress

The Royal Observatory of Belgium, based upon data received from its worldwide network of three dozen observatories, reports a mean sunspot number of 100 for October 2000. A high count of 164 was recorded on October 2nd, with a low of 57 reported on the 10th. October's mean value results in a 12-month running smoothed sunspot number of 121 centered on April 2000. This is a one point increase from March's level.

A smoothed sunspot number of approximately 117 is forecast for February 2001, as Cycle 23 appears to be declining slowly from its peak level, which is believed to have occurred during July or August 2000. It will be several months before this can be confirmed.

Canada's Dominion Radio Astrophysical Observatory in Penticton, British Columbia reports a 10.7 cm solar flux level of 168 for October 2000. This results in a smoothed value of 181 centered on April 2000. A smoothed 10.7 cm solar flux level of approximately 182 is predicted for February 2001.

February Conditions

Although the present sunspot cycle probably reached its peak this past summer, the sunspot count is expected to remain near peak levels this February.

During the daylight hours of February expect good or better DX propagation simultaneously on six bands. Fifteen meters is likely to be the best band from shortly after sunrise until just after sunset, with 10, 12, 17, and 20 meters not far behind. The 6 meter band should be an extra DX bonus this month during the hours of daylight. Be sure to check this

Geographical Area	November 25	November 26
Polar	Low Normal	Low/Below Normal*
Auroral	Low Normal	Low/Below Normal*
Middle Latitude	High Normal	High/Low Normal
Low Latitude	High/Above Normal	High/Above Normal
Equatorial	Above/High Normal	Above/High Normal
10.7 cm Radio Flux	201	202
Sunspot Count	74	59
WW Geomagnetic Ap Index	7	22
WW Geomagnetic Kp Index	1.9	3.1

Table I– Summary of HF propagation conditions based on reports from NOAA during the CQ WW DX CW Contest weekend of November 25–26 and from initial reports received from contest participants.

band for unusual DX openings, particularly when conditions are expected to be High Normal or better. Look for openings toward Europe and the east before noon, toward the South Pacific and the west during the late afternoon, and toward Central and South America throughout most of the daylight hours. The best times to listen for 6 meter DX openings are shown in the DX Propagation Charts by a **.

During the period from sundown to midnight as many as seven bands may be available for DX. Fifteen and 17 meters should hold up well past sundown for DX openings towards Central and South America, the Pacific area, and the Far East and Asia. Twenty meters should remain open to most areas of the world during this period, but with signals strongest from southerly and westerly directions. Good DX toward the east and the south should also be possible on 30, 40, and 80 meters, with some openings in the same directions also possible on 160 meters.

Between midnight and the sunrise period it should be a toss-up among 20, 30, and 40 meters for worldwide DX honors. Good DX openings to most areas of the world should also be possible on 80 meters. Be sure to check 160 meters for some unusual DX openings during this period, too.

	UT							
Planetary Kp Index	**00-03**	**03-06**	**06-09**	**09-12**	**12-15**	**15-18**	**18-21**	**21-24**
November 25	3	3	0	1	1	2	3	2
November 26	1	1	3	2	4	4	5	5

Table II– Worldwide geomagnetic indices (planetary Kp) reported every three hours during the CW contest weekend of November 25–26. Levels 0 and 1 are exceptionally quiet and stable conditions; 2 quiet to unsettled; 3 unsettled; 4 active; and 5 minor storminess.

Beginning late in February and continuing though March and early April, expect considerable improvement in DX conditions between the northern and southern hemispheres. This will result from the effects of the spring equinox period, as the sun crosses the equator in its apparent travels toward northern skies. These improved interhemispheric conditions should be noticeable on all bands 6 through 160 meters, and on circuits mainly between the United States and South America, southern and central Africa, Australasia, Antarctica, and parts of Asia. Equinoctial propagation conditions tend to maximize during the sunrise and sunset periods, and over both short- and long-path openings.

This month's propagation charts contain band-opening predictions for major DX paths for the period February 15 through April 15, 2001. A short-skip propagation forecast for February appeared in last month's column.

VHF Ionospheric Openings

6 Meters: As mentioned earlier in this column, expect unusually good DX conditions on the 6 meter band during the hours of daylight, with *F*-layer openings to many areas of the world from the United States. Another form of 6 meter propagation, trans-equatorial scatter

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Current Baluns

B1-2K	1:1	2 KW SSB	80-10m Current Balun	$24.95
B1-5K	1:1	5 KW SSB	160-10m Precision	$35.95
B1-1KV	1:1	1 KW SSB	15 - 2 m VHF balun	$29.95
Y1-5K	1:1	5 KW SSB	160-10m "YagiBalun"	$37.95
B4-1KXV	4:1	1 KW SSB	15 - 2 m VHF balun	$33.95
B4-2KX	4:1	2 KW SSB	160-10m Precision	$49.95

NEW RFI QUICK FIX

For really tough RFI and RF feedback problems, you can't beat the new T-4 and T-4G Ultra Line Isolators. It's isolation factor is 50% higher than previous models - far better than expensive imported copies. The T-4G goes even further with it's built-in ground strap for direct line Isolator grounding. Before coax enters your shack, stray RFI is shunted directly to ground. Use with Vertical antennas at feed point. To prevent ground loop problems, install two T-4s between your transmitter, linear and tuner. Use with any antenna to reduce feed line radiation. This is the RFI BIG GUN.

All Line Isolators have SO-239 input and output connectors. 160-10 m, 2 KW+, winding Z @ 3.5 MHz > 75K, @ 14 MHz > 50 K

T-4	Same as T-4G but without direct grounding	$34.95
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T-5G	Marine version, HF & VHF isolation -the best	$49.95
T-6	VHF version of T-4 15 - 2 meters, 1 KW	$31.95

Jim's New Book - "Frequently Asked Questions about Antenna Systems and Baluns." This 120 page book answers questions and dispels myths. The material is presented in a style that's easy to read and Jim, W4THU, is not beyond poking fun at jealously held concepts that don't quite hold up under close scrutiny. However, at the heart of this book are questions that a lot of hams ask over and over again. Available now - $12.95 + $3 postage.

Antenna Wire and Parts

"And, not a dog in the bunch!"

PL-259ST	Silver-Teflon, U.S.A.	SALE	$1.00
PL-259GT	Gold-Teflon, U.S.A.	$1.49 or $30 pk of 25	
N-200	'N' Silver-Teflon, installs like a PL-259		$3.00
		Coax & cable prices	<100'/100'+
RG-8X Plus	Type IIA non-contaminating jacket, 95%		26¢/22¢
RG-213 Plus	Enhanced, 96%+super quality jacket		54¢/38¢

SALE 100' or more
RG-8X Premium, 95% braid 14¢
RG-213 Top Quality, 95% 35¢
ExtraFlex Flexible 9913-type 59¢

R1 Rotator	8 conductor (2 x #18, 6 x #24	SALE	26¢/20¢
R2 Rotator	8 conductor (2 x #16, 6 x #18)	SALE	47¢/35¢
#14 HD	Stranded, 7-conductor hard-drawn		8¢
#14 FlexWeave	168-strand, bare, for any wire ant.		14¢
#12 FlexWeave	259-strand, excellent for long runs		19¢
#13 Insulated	Very tough jacket, strong, for heavy weather		16¢
450 Ladder	#16 stranded conductor, poly.	SALE	22¢/17¢
450 Ladder	#14 stranded conductors, poly	SALE	30¢/26¢
1/2" Braid	Tinned-copper, for grounding, any length		65¢
2" Strap	Copper strap, heavy .020" thick any length		$1.75

Pulleys - for antenna support rope. Highest quality, small, lightweight, sailboat type - #224 for 3/16" rope $11.95 or #082 for 5/16" rope $13.95

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On the Cover

If you look very closely, you can see Bob Magnani, K6QXY, standing in the middle of his 6 meter moonbounce array at his station in Santa Rosa, California. The four-square array of custom-made M^2 Yagis—13 elements each on 67 foot booms spaced 39 feet apart horizontally and 37 feet apart vertically—is one of the two biggest 6 meter EME (Earth-Moon-Earth) arrays in the world. The other, a nearly identical setup, is owned by Jimmy Treybig, W6JKV, in Texas. The center line of the H-frame is 55 feet off the ground, putting Bob at about, well, let's just say he's way up there! The entire antenna rotates for azimuth, using a homebrew system, and the elevation rotor, also homebrew, lets the antenna climb from 0 to 80 degrees in elevation.

Bob has worked 40 different stations off the moon on 6 meters, including Australia (a VK EME record) and seven European countries he says would otherwise have been impossible to work from the US West Coast. His total also includes about 15 single-Yagi stations worked at their moonrise or moonset, when the Earth provides additional "ground gain" on EME signals. If 40 different stations doesn't sound like a lot, it's only because putting out a good signal on 6 meter EME requires a pretty fair amount of real estate, and Bob figures there are only 50–60 people active, including only seven or eight worldwide with fully steerable arrays.

Bob says he can hear someone with a pretty good-size 6 meter Yagi (55 foot boom or so), about 700–800 watts at the antenna, and ground gain from moonrise or moonset. He invites 6 meter DXers to give it a try (He says you'll have no trouble hearing him!), and says there's a 6 meter EME scheduling page on the World Wide Web at <http://web.jzap.com/k7rat/sixeme.html>.

To learn about getting started in EME, see "An EME Primer" on page 52 of this issue. *(Cover photo by Larry Mulvehill, WB2ZPI)*

HOW TO USE THE DX PROPAGATION CHARTS

1. Use chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4, and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9, and 0 areas; the Western USA Chart in the 6 and 7 areas; and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (10 through 80 meters) for a particular DX region, as shown in the left-hand column of the charts. An * indicates the best time to listen for 160 meter openings. An ** indicates best time to check for 6 meter openings.

3. The propagation index is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of days during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual dates on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. Appropriate *standard* time is used, not GMT. To convert to GMT, add to the times shown in the appropriate chart 8 hours in PST Zone, 7 hours in MST Zone, 6 hours in CST Zone, and 5 hours in EST Zone. For example, 13 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 04 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts CW, or 1 kw, PEP on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level; for each 10 dB loss, it will lower by one level.

6. Propagation data contained in the charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado 80302.

February 15 - April 15, 2001
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	10 meters	*15 meters*	*20 meters*	*40/80 meters*
Western & Central Europe & N. Africa	08-09 (1) 09-10- (2) 10-12 (3) 12-13 (4) 13-14 (2) 14-15 (1) 09-11 (1)**	06-07 (1) 07-08 (2) 08-11 (3) 11-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	00-03 (1) 03-06 (2) 06-09 (3) 09-11 (2) 11-13 (3) 13-18 (4) 18-22 (3) 22-00 (2)	17-18 (1) 18-19 (2) 19-22 (3) 22-01 (4) 01-02 (3) 02-03 (2) 03-04 (1) 19-21 (1)* 21-00 (2)* 00-02 (1)
Northern Europe & European CIS	08-09 (1) 09-10 (2) 10-11 (3) 11-12 (2) 12-13 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-14 (1)	00-02 (3) 02-03 (2) 03-05 (1) 05-07 (2) 07-09 (3) 09-14 (2) 14-18 (3) 18-21 (2) 21-00 (1)	17-19 (1) 19-22 (2) 22-01 (3) 01-02 (2) 02-03 (1) 20-01 (1)*
Eastern Mediterranean & Middle East	08-09 (1) 09-11 (2) 11-12 (3) 12-13 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-13 (4) 13-14 (2) 14-15 (1)	04-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-15 (3) 15-17 (4) 17-20 (3) 20-22 (2) 22-02 (3) 02-04 (2)	18-20 (1) 20-23 (2) 23-00 (1) 20-23 (1)*
Western Africa	07-10 (1) 10-12 (2) 12-13 (3) 13-15 (4) 15-16 (3) 16-18 (2) 18-19 (1) 08-12 (1)**	06-09 (1) 09-11 (2) 11-14 (3) 14-17 (4) 17-18 (3) 18-19 (2) 19-21 (1)	02-06 (2) 06-13 (1) 13-15 (2) 15-17 (3) 17-00 (4) 00-02 (3)	18-20 (1) 20-22 (2) 22-00 (3) 00-02 (2) 02-03 (1) 22-02 (1)*
Southern Africa	07-08 (1) 08-10 (2) 10-11 (3) 11-13 (4) 13-14 (2) 14-15 (1) 11-13 (1)**	06-10 (1) 10-12 (2) 12-14 (3) 14-17 (4) 17-18 (2) 18-19 (1)	05-07 (2) 07-14 (1) 14-15 (2) 15-17 (3) 17-20 (4) 20-21 (2) 21-23 (1) 23-02 (2) 02-03 (2) 03-05 (1)	18-20 (1) 20-23 (2) 23-00 (1) 21-23 (1)*
Eastern & Central Africa	09-11 (1) 11-13 (2) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1) 09-11 (1)**	07-09 (1) 09-11 (2) 11-13 (3) 13-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-23 (4) 23-02 (3) 02-03 (2) 03-05 (1)	19-23 (1) 23-01 (2) 01-02 (1) 23-01 (1)*
Central & South Asia	08-11 (1) 19-21 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (2) 12-13 (1) 19-20 (1) 20-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 17-19 (1) 19-21 (3) 21-22 (2) 22-00 (1)	19-22 (1) 04-06 (1)
Southeast Asia	10-13 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 12-14 (2) 14-18 (1) 18-21 (2) 21-22 (1)	05-07 (1) 07-09 (2) 09-11 (1) 14-17 (1) 19-20 (1) 20-23 (2) 23-01 (1)	05-07 (1)
Far East	09-11 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-12 (1) 15-16 (1) 16-17 (2) 17-19 (3) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (3) 09-11 (2) 11-13 (1) 17-19 (1) 19-22 (2) 22-00 (3) 00-02 (2) 02-03 (1)	05-08 (1)
South Pacific & New Zealand	08-12 (1) 12-14 (2) 14-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 16-18 (1)**	07-08 (1) 08-10 (2) 10-13 (1) 13-16 (2) 16-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	11-19 (1) 19-21 (2) 21-23 (3) 23-03 (4) 03-05 (3) 05-07 (2) 07-09 (3) 09-11 (2)	00-01 (1) 01-02 (2) 02-05 (3) 05-07 (2) 07-08 (1) 01-03 (1)* 03-06 (2)* 06-07 (1)*
Austral-asia	09-11 (1) 14-15 (1) 15-16 (2) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 17-19 (1)**	08-09 (1) 09-12 (3) 12-15 (1) 15-16 (2) 16-19 (3) 19-21 (2) 21-22 (3) 22-23 (2) 23-00 (1)	06-08 (2) 08-10 (4) 10-12 (2) 12-15 (1) 15-17 (2) 17-21 (1) 21-23 (2) 23-02 (3) 02-03 (2) 03-06 (1)	02-04 (1) 04-05 (2) 05-06 (3) 06-07 (2) 02-05 (1)* 05-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	07-08 (1) 08-09 (2) 09-16 (4) 16-18 (3) 18-19 (2) 19-20 (1) 09-11 (1)**	05-06 (1) 06-07 (2) 07-11 (4) 11-13 (3) 13-19 (4) 19-21 (3) 21-22 (2) 22-00 (1)	03-05 (2) 05-06 (3) 06-09 (4) 09-10 (3) 10-14 (2) 14-16 (3) 16-00 (4) 00-03 (8)	18-19 (1) 19-20 (2) 20-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 20-22 (1)* 22-03 (2)* 03-05 (1)**
Peru, Paraguay, Brazil, Argentina, Uruguay, Bolivia, & Chile	07-08 (1) 08-10 (3) 10-13 (2) 13-15 (3) 15-17 (4) 17-18 (2) 18-19 (1) 01-12 (1)** 15-17 (1)**	06-07 (1) 07-10 (2) 10-13 (1) 13-15 (2) 15-16 (3) 16-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	15-16 (1) 16-17 (2) 17-18 (3) 18-02 (4) 02-03 (3) 03-04 (2) 04-05 (1) 05-07 (2) 07-09 (1)	19-21 (1) 21-00 (2) 00-03 (3) 03-04 (2) 04-06 (1) 21-05 (1)**
McMurdo Sound, Antarctica	16-17 (1) 17-19 (2) 19-20 (1)	12-16 (1) 16-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-05 (2) 05-06 (1) 06-08 (2) 08-09 (1)	23-01 (1) 01-05 (2) 05-06 (1)

Time Zones: CST & MST
(24-Hour Time)
CENTRAL USA TO:

	10 meters	*15 meters*	*20 meters*	*40/80 meters*
Western & Central Europe & N. Africa	08-10 (1) 10-12 (2) 12-13 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	00-06 (1) 06-09 (2) 09-11 (1) 11-13 (2) 13-15 (3) 15-17 (4) 17-20 (3) 20-00 (2)	17-19 (1) 19-22 (2) 22-00 (3) 00-01 (2) 01-02 (1) 20-22 (1)* 22-00 (2)* 00-01 (1)*
Northern Europe & European CIS	08-09 (1) 09-11 (2) 11-12 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-14 (1)	07-10 (2) 10-13 (1) 13-15 (2) 15-18 (3) 18-20 (2) 20-22 (1) 22-02 (2) 02-07 (1)	19-22 (1) 22-00 (2) 00-02 (1) 22-01 (1)*
Eastern Mediterranean & Middle East	09-10 (1) 10-11 (2) 11-12 (1)	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-14 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-14 (2) 14-18 (3) 18-20 (2) 20-23 (3) 23-01 (2) 01-02 (1)	19-22 (1) 20-22 (1)*
Western Africa	08-09 (1) 09-11 (2) 11-12 (3) 12-14 (4) 14-16 (3) 16-17 (2) 17-18 (1) 08-10 (1)**	06-08 (1) 08-10 (2) 10-13 (3) 13-16 (4) 16-17 (3) 17-19 (2) 19-20 (1)	04-06 (2) 06-12 (1) 12-15 (2) 15-17 (3) 17-23 (4) 23-01 (3) 01-02 (2) 02-04 (1)	18-20 (1) 20-23 (2) 23-01 (1) 21-00 (1)*
Southern Africa	07-08 (1) 08-10 (2) 10-11 (3) 11-12 (4) 12-13 (2) 13-14 (1) 11-13 (1)**	07-09 (1) 09-11 (2) 11-12 (3) 12-16 (4) 16-17 (2) 17-18 (1)	05-07 (2) 07-13 (1) 13-15 (2) 15-16 (3) 16-19 (4) 19-20 (3) 20-22 (2) 22-00 (3) 00-02 (2) 02-05 (1)	19-20 (1) 20-21 (2) 21-22 (1) 20-21 (1)*
Eastern & Central Africa	09-11 (1) 11-13 (2) 13-16 (4) 16-17 (2) 17-18 (1) 13-15 (1)**	08-09 (1) 09-12 (2) 12-16 (3) 16-18 (4) 18-19 (2) 19-20 (1)	12-14 (1) 14-16 (2) 16-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	19-20 (1) 20-22 (2) 22-23 (1) 20-22 (1)*
Central & S.Asia	07-09 (1) 18-20 (1)	07-08 (1) 08-10 (2) 10-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-09 (2) 09-11 (1) 16-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-02 (1)	05-07 (1) 18-20 (1)
Southeast Asia	09-10 (1) 10-12 (2) 12-14 (1) 16-17 (1) 17-19 (3) 19-20 (2) 20-21 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-13 (2) 13-17 (1) 17-21 (2) 21-22 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-18 (1) 18-21 (2) 21-23 (1)	04-07 (1)
Far East	15-16 (1) 16-17 (2) 17-18 (3) 18-19 (2) 19-20 (1)	09-11 (1) 14-16 (1) 16-17 (2) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (2)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-16 (1) 16-20 (2) 20-22 (1) 22-00 (3) 00-02 (2) 02-03 (1)	02-04 (1) 04-06 (2) 06-08 (1) 05-07 (1)*
South Pacific & New Zealand	10-12 (1) 12-14 (2) 14-16 (3) 16-19 (4) 19-20 (2) 20-21 (1) 11-14 (1)** 17-19 (1)**	08-12 (1) 12-14 (2) 14-16 (1) 16-18 (2) 18-19 (3) 19-22 (4) 22-23 (3) 23-01 (2) 01-02 (1)	17-19 (1) 19-21 (2) 21-23 (3) 23-04 (4) 04-05 (3) 05-07 (2) 07-09 (4) 09-10 (3) 10-11 (2) 11-12 (1)	22-00 (1) 00-01 (2) 01-06 (3) 06-07 (2) 07-08 (1) 00-02 (1)* 02-05 (2)* 05-07 (1)*
Austral-asia	09-11 (1) 14-15 (1) 15-16 (2) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1) 16-18 (1)**	07-08 (1) 08-11 (3) 11-14 (1) 14-16 (2) 16-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-00 (1)	05-07 (2) 07-08 (3) 08-10 (4) 10-12 (2) 12-14 (1) 14-16 (2) 16-21 (1) 21-23 (2) 23-01 (3) 01-04 (4) 04-05 (3)	02-04 (1) 04-06 (3) 06-07 (2) 07-08 (1) 04-05 (1)* 05-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	07-08 (1) 08-09 (2) 09-10 (3) 10-16 (4) 16-18 (3) 18-19 (2) 19-20 (1) 09-11 (1)**	06-07 (1) 07-08 (2) 08-10 (4) 10-13 (3) 13-19 (4) 19-20 (3) 20-21 (2) 21-23 (1)	06-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-23 (4) 23-02 (3) 02-05 (2) 05-06 (3)	18-19 (1) 19-20 (2) 20-00 (3) 00-02 (4) 02-03 (3) 03-04 (2) 04-06 (1) 19-21 (1)* 21-03 (2)* 03-05 (1)*

Peru,	07-08 (1)	06-07 (1)	13-15 (1)	19-20 (1)
Paraguay,	08-10 (3)	07-10 (2)	15-16 (2)	20-00 (2)
Brazil,	10-12 (2)	10-13 (1)	16-18 (3)	00-02 (3)
Argentina,	12-14 (3)	13-14 (2)	18-01 (4)	02-03 (2)
Uruguay,	14-16 (4)	14-16 (3)	01-03 (3)	03-04 (1)
Bolivia,	16-17 (3)	16-20 (4)	03-05 (2)	21-03 (1)*
Chile	17-18 (2)	20-22 (3)	05-07 (3)	
	18-19 (1)	22-00 (2)	07-08 (2)	
	09-11 (1)**	00-01 (1)	08-09 (1)	
	14-16 (1)**			
McMurdo	14-16 (1)	13-16 (1)	16-19 (1)	22-02 (1)
Sound	16-19 (2)	16-18 (2)	19-20 (2)	02-04 (2)
Antarctica	19-20 (1)	18-21 (3)	20-04 (3)	04-06 (1)
		21-22 (2)	04-05 (2)	
		22-23 (1)	05-07 (1)	
			07-08 (2)	
			08-10 (1)	

Time Zones: PST (24-Hour Time) WESTERN USA TO:

	10 meters	*15 meters*	*20 meters*	*40/80 meters*
Western Europe & N. Africa	08-09 (1) 09-11 (2) 11-12 (1)	07-08 (1) 08-10 (2) 10-12 (3) 12-13 (2) 13-14 (1) 19-21 (1)	00-06 (1) 06-09 (2) 09-11 (1) 11-14 (2) 14-16 (3) 16-19 (2) 19-22 (1) 22-00 (2)	19-20 (1) 20-22 (2) 22-00 (1) 20-22 (1)*
Central & Northern Europe & European CIS	08-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (1) 19-21 (1)	05-06 (1) 06-09 (2) 09-12 (1) 12-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	19-21 (1) 21-23 (2) 23-00 (1) 21-23 (1)*
Eastern Mediter-ranean & Middle East	o8-09 (1) 09-10 (2) 10-11 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-12 (1) 20-22 (1)	05-06 (1) 06-09 (2) 09-12 (1) 12-16 (2) 16-18 (1) 18-22 (2) 22-02 (1)	18-21 (1)
Western & Central Africa	08-10 (1) 10-12 (2) 12-14 (3) 15-16 (1)	07-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	01-06 (1) 06-08 (2) 08-12 (1) 12-15 (2) 15-17 (3) 17-21 (4) 21-00 (3) 00-01 (2)	18-22 (1)
Eastern Africa	09-12 (1) 12-14 (2) 14-15 (1)	08-11 (1) 11-14 (2) 14-16 (3) 16-17 (2) 17-18 (1)	06-08 (1) 12-14 (1) 14-16 (2) 16-20 (3) 20-22 (2) 22-23 (1)	18-20 (1)
Southern Africa	07-08 (1) 08-11 (3) 11-12 (2) 12-13 (1)	06-09 (1) 09-12 (2) 12-15 (3) 15-16 (2) 16-17 (1)	04-06 (1) 06-08 (2) 08-13 (1) 13-15 (2) 15-18 (3)	18-21 (1)
			18-19 (2) 19-21 (1) 21-23 (3) 23-00 (2) 00-02 (1)	
Central & S. Asia	07-09 (1) 17-18 (1) 18-19 (3) 19-20 (2) 20-21 (1)	07-08 (1) 08-10 (2) 10-11 (1) 16-17 (1) 17-19 (2) 19-20 (3) 20-21 (2) 21-22 (1)	16-18 (1) 18-21 (2) 21-23 (1) 02-03 (1) 03-05 (2) 05-07 (1) 07-09 (3) 09-10 (2) 10-12 (1)	05-07 (1) 18-20 (1)
Southeast Asia	08-09 (1) 09-11 (2) 11-12 (1) 14-15 (1) 15-16 (2) 16-18 (4) 18-19 (2) 19-20 (1) 16-18 (1)**	07-08 (1) 08-10 (4) 10-12 (3) 12-17 (1) 17-20 (3) 20-21 (2) 21-22 (1)	23-01 (1) 01-03 (2) 03-06 (3) 06-07 (2) 07-09 (3) 09-11 (2) 11-14 (1)	00-02 (1) 02-05 (2) 05-07 (1)
Far East	14-15 (1) 15-16 (2) 16-18 (4) 18-19 (2) 19-20 (1) 15-17 (1)**	08-10 (2) 13-14 (1) 14-15 (2) 15-17 (3) 17-20 (4) 20-21 (3) 21-22 (1)	04-06 (2) 06-07 (1) 07-08 (3) 08-09 (4) 09-10 (3) 10-11 (2) 11-19 (1) 19-21 (2) 21-23 (4) 23-00 (3) 00-03 (2) 03-04 (3)	00-02 (1) 02-05 (2) 05-06 (3) 06-07 (2) 07-08 (1) 02-04 (1)* 04-06 (2)* 06-07 (1)*
South Pacific & New Zealand	09-10 (1) 10-12 (3) 12-16 (2) 16-20 (4) 20-21 (3) 21-22 (1) 10-12 (1)** 18-20 (1)**	07-08 (1) 08-09 (2) 09-11 (3) 11-17 (2) 17-18 (3) 18-22 (4) 22-23 (3) 23-01 (2) 01-02 (1)	06-07 (3) 07-09 (4) 09-10 (3) 10-11 (2) 11-17 (1) 17-19 (2) 19-20 (3) 20-01 (4) 01-04 (3) 04-06 (2)	19-21 (1) 21-22 (2) 22-23 (3) 23-05 (4) 05-06 (3) 06-07 (2) 07-08 (1) 22-01 (1)* 01-05 (2)* 05-06 (1)*
Austral-asia	11-13 (1) 13-14 (2) 14-16 (3) 16-19 (4) 19-20 (3) 20-21 (1) 16-18 (1)**	06-07 (1) 07-09 (3) 09-11 (2) 11-13 (1) 13-15 (2) 15-17 (1) 17-18 (2) 18-21 (4) 21-22 (2) 22-23 (1)	12-20 (1) 20-22 (2) 22-00 (3) 00-04 (4) 04-06 (3) 06-08 (4) 08-10 (3) 10-12 (2)	00-01 (1) 01-02 (2) 02-06 (3) 06-07 (2) 07-08 (1) 02-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	07-08 (1) 08-09 (2) 09-10 (3) 10-16 (4) 16-17 (3) 17-18 (1) 09-11 (1)**	05-06 (1) 06-07 (2) 07-09 (4) 09-14 (3) 14-17 (4) 17-18 (3) 18-20 (2) 20-21 (1)	05-07 (4) 07-09 (3) 09-14 (2) 14016 (3) 16-22 (4) 22-00 (3) 00-03 (2) 03-05 (3)	18-20 (1) 20-01 (3) 01-04 (2) 04-06 (1) 19-21 (1)* 21-03 (2)* 03-04 (1)*
Peru, Bolivia Paraguay, Brazil, Argentina, Uruguay,	07-08 (1) 08-09 (3) 09-11 (2) 11-14 (3) 14-17 (4) 17-18 (2)	06-07 (1) 07-09 (2) 09-12 (1) 12-14 (2) 14-15 (3) 15-20 (4)	12-14 (1) 14-16 (2) 16-18 (3) 18-01 (4) 01-02 (3) 02-06 (2)	19-21 (1) 21-23 (2) 23-01 (3) 01-02 (2) 02-03 (1) 22-02 (1)*
Chile	18-19 (1) 09-11 (1)**	20-23 (3) 23-00 (2) 00-01 (1)	06-08 (1)	
McMurdo Sound, Antarctica	13-14 (1) 14-18 (2) 18-19 (1)	14-16 (1) 16-17 (2) 17-19 (3) 19-21 (4) 21-22 (3) 22-23 (2) 23-00 (1)	16-18 (1) 18-19 (2) 19-21 (3) 21-02 (4) 02-04 (3) 04-05 (2) 05-07 (1) 07-08 (2) 08-09 (1)	22-02 (1) 02-04 (2) 04-06 (1)

*Indicates best times to listen for 80 meter openings. Openings on 16o meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2) or higher.
**Indicates best times to listen for F-2 layer openings on 6 meters.
For 12 meter openings interpolate between 10 and 15 meter openings.
For 17 meter openings interpolate between 15 and 20 meter openings.
For 30 meter openings interpolate between 40 and 20 meter openings.

(TE), usually peaks during the equinoctial period. Some TE openings should be possible during February between the southern tier states and South America. The best time to check for such openings is between 7 and 10 PM local time. Some TE openings may also be possible on 2 meters at the same time.

Meteors: *Delta Leonids*, a minor meteor shower, should begin on February 5th and continue through mid-March. The meteor rate from this shower is very low, but some *E*-layer ionization might be produced when it reaches it peak on February 24th.

Auroras: Radio storminess usually increases during the equinoctial period. These storms are likely to produce some widespread auroras, with increased chances for auroral-type 6 and 2 meter openings over distances up to approximately 1300 miles. Check the Last-Minute Forecast at the beginning of this column for those days during February that are expected to be Disturbed or Below Normal. Frequent daily updates of aurora information, as well as geomagnetic, solar, and ionospheric data, can be found on the web at <http://dx.qsl.net/propagation> and at <http://hfradio.org/propagation.html>.

For a much more complete review of VHF propagation see Joe Lynch's informative "VHF Plus" column appearing monthly in *CQ*.

50th Anniversary

Next month my column will celebrate its 50th anniversary. I met my first column deadline for the March 1951 edition of *CQ*, and I have met each one ever since, month after month, for 50 years! I have been told, but without confirmation as yet, that this record may qualify for the *Guiness Book of Records*. I'll have much to reminisce about in next month's column.

73, George, W3ASK

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Number groups after call letters denote following: Band (A = all), Final Score, Number of QSOs, and Prefixes. An asterisk (*) before a call indicates low power. Certificate winners are listed in boldface. (Note that the country names and groupings reflect the DXCC list at the time of the contest.)

SSB RESULTS
QRP/p SECTION
WORLDWIDE

KR2Q	**A**	**2,688,158**	**1452**	**649**
KP4FP	**A**	**2,352,180**	**1369**	**597**
NX7K	**A**	**2,025,510**	**1262**	**631**
VE3KZ	**A**	**1,265,841**	**849**	**519**
YU1KN	**A**	**1,086,085**	**949**	**539**
LY1ØBA	**A**	**1,080,000**	**967**	**540**
			(Op: LY3BA)	
HA5BSW	**A**	**1,075,611**	**894**	**537**
8S5W	**A**	**930,230**	**837**	**485**
			(Op: SM5IMO)	
NØKE	**A**	**879,592**	**753**	**452**
SM3C	*	819,970	799	491
			(Op: SM5CCT)	
JA1YNE	**A**	**762,720**	**687**	**420**
LU1VK	**A**	**670,536**	**620**	**402**
KB3TS	**A**	**620,135**	**606**	**365**
UA4YJ	**A**	**475,847**	**681**	**391**
S59D	**A**	**420,000**	**587**	**350**
AN1GT	**A**	**403,700**	**638**	**367**
WZ2T	*	280,704	406	272
N1TM	**A**	**218,776**	**331**	**232**
DH2UL	**A**	**177,660**	**291**	**208**
VE6BF	**A**	**139,194**	**249**	**198**
PA3EXS	**A**	**138,601**	**263**	**232**
N7JXS	*	130,617	269	207
G3FNM	**A**	**106,600**	**300**	**200**
NQ7X	*	81,180	213	164
OK1AIJ	**A**	**60,030**	**203**	**174**
RAØCCV/3	*	57,376	150	128
CT1DYV	**A**	**43,424**	**142**	**118**
ON7CC	**A**	**42,512**	**172**	**147**
AN5BAO	*	31,734	137	123
HB9AYZ	**A**	**25,536**	**140**	**114**
AF9J	**A**	**22,736**	**114**	**98**
RAØCAH	**A**	**14,170**	**156**	**111**
UAØKCL	*	12,835	91	85
N8XA	**A**	**11,316**	**46**	**41**
GM4ELV	**A**	**10,241**	**95**	**77**
UAØSE	*	6,550	51	50
RA4UAT	*	5,922	48	47
DL2YET	*	3,081	41	29
UU9JQ	**A**	**2,106**	**41**	**39**
YO4AAC	**A**	**1,344**	**25**	**24**
K2CY	*	1,035	23	23
DL3JRA	*	600	20	20
US2YW	*	495	15	15
JA5GPJ	**28**	**755,478**	**624**	**423**
FB1BON	**28**	**687,360**	**744**	**384**
SP3LWP	**28**	**466,926**	**509**	**354**
JR4DAH	*	454,545	459	351
LY2FE	**28**	**424,180**	**490**	**334**
WA6FGV	**28**	**164,032**	**323**	**233**
HAØGK	**28**	**134,592**	**266**	**192**
OH5NHI	**28**	**122,008**	**246**	**202**
AN1BOI	**28**	**80,592**	**223**	**184**
UR5FEO	**28**	**77,550**	**235**	**165**
W7/JR1NKN	**28**	**70,950**	**205**	**150**
N2JNZ	**28**	**64,960**	**165**	**145**
UR5FCM	*	55,860	195	140
RV9UF	**28**	**50,250**	**146**	**125**
DL2JRM	**28**	**44,505**	**145**	**129**
LW7DQW	**28**	**37,145**	**135**	**115**
YO9GZU	**28**	**33,744**	**154**	**111**
JH6SQI	*	32,200	110	100
HA5ORK	*	22,950	111	90
SP3BLT	*	13,440	74	64
YO3III	*	6,549	61	60
W3MGL	**28**	**6,210**	**50**	**46**
PA2REH	**28**	**2,077**	**31**	**31**
YL2MF	**28**	**2,057**	**51**	**47**
EA1DVY	*	297	11	11
CT1ETE	**21**	**498,225**	**571**	**455**
NA4CW	**21**	**409,952**	**467**	**368**
JH1HRJ	**21**	**351,946**	**409**	**322**
4N1DX	**21**	**296,184**	**376**	**328**
DL8TWA	**21**	**118,810**	**280**	**218**
			(Op: K3TW)	
JH1KZQ/1	**21**	**11,284**	**72**	**62**
LA4OGA	**21**	**1,161**	**29**	**27**
6GØV	**14**	**1,045,476**	**923**	**452**
			(Op: XE2Z)	
UA9AAZ	**14**	**345,300**	**409**	**300**
YO4GHW	**14**	**98,340**	**296**	**220**
W6CN	**14**	**73,872**	**177**	**162**
YU1OO	**14**	**53,856**	**229**	**187**
WB7OCV	**14**	**47,085**	**138**	**129**
W6QU	**7**	**12,420**	**70**	**60**
JA2HUN	**7**	**952**	**14**	**14**
SP4GFG	**3.7**	**78,657**	**210**	**167**
OK1GW	**3.7**	**63,428**	**189**	**157**
YO6PED	**3.7**	**2,736**	**37**	**36**
W8QZA/6	**3.7**	**2,112**	**38**	**33**
US7MQ	**1.8**	**8,382**	**71**	**66**
YT1IA	**1.8**	**595**	**18**	**17**

SINGLE OPERATOR
NORTH AMERICA
UNITED STATES

KQ2M	**A**	**11,875,240**	**3987**	**1066**
NB1B	**A**	**9,568,953**	**3259**	**1017**
KR1G	**A**	**8,498,492**	**3294**	**929**
K1TTT	*	7,773,822	3105	927
			(Op: N9KAU)	
W1CU	*	5,171,166	2210	858
NT1N	*	3,067,792	1578	728
KT1O	*	2,186,484	1240	618
K5ZD	*	2,084,437	1232	587
KZ1K	*	1,643,362	1033	574
			(Op: K1PLX)	
N1YKH	**28**	**24,447**	**99**	**87**
WA1MKS	**14**	**123,205**	**228**	**205**
KE1Y	**3.7**	**921,930**	**704**	**389**
***AA1EY**	**A**	**1,927,843**	**1090**	**593**
***WS1A**	**A**	**1,787,722**	**1121**	**562**
***KX1X**	**A**	**1,298,345**	**1004**	**485**
*N1WK	*	1,294,896	922	509
*K1HT	*	801,365	660	415
*AA1SU	*	649,934	670	398
*KA1JVR	*	379,472	494	296
*W1TO	*	253,669	360	247
*WA1ZYX	*	176,579	291	221
*N1XT	*	104,486	230	178
*WA1WFH	*	85,536	188	162
***WE1USA**	**28**	**3,134,799**	**1593**	**711**
***WG1Z**	**28**	**1,134,159**	**833**	**507**
*N1FUS	*	270,772	359	278
*KY1B	*	168,714	278	234
*KA1RLI	*	134,618	244	211
*W1MBT	*	110,784	227	192
			(Op: K1TS)	
*K1VSJ	*	4,028	38	38
***AE1B**	**21**	**1,215,459**	**904**	**531**
***WA1FCN**	**21**	**480,000**	**476**	**384**
WW2Y	**A**	**9,797,562**	**3701**	**963**
			(Op: N2NT)	
N1EU	**A**	**4,586,296**	**1908**	**844**
K2FR	**A**	**1,067,838**	**796**	**493**
AF2K	*	1,008,420	808	490
WR2V	*	485,961	518	317
W2EZ	*	173,116	308	226
W2UDT	*	107,047	216	167
W2FUI	*	56,232	160	132
W2LE	*	42,827	135	113
NA2M	*	24,354	100	99
NA2X	**28**	**349,943**	**455**	**319**
NI2P	**14**	**8,208**	**57**	**54**
***KG2AU**	**A**	**1,972,000**	**1223**	**580**
***NJ1F**	**A**	**738,285**	**700**	**415**
***WA2JQK**	**A**	**654,878**	**600**	**406**
*KA2D	*	608,457	588	381
*N3KCJ	*	527,648	568	352
*W2MKW	*	322,800	416	300
*N2CK	*	319,158	424	298
*N2LQQ	*	282,620	419	260
*W2FGY	*	64,008	160	126
*K2SZ	*	42,598	135	118
*W2PI	*	38,822	146	118
*K2YLH	*	37,510	141	121
*N2HTT	*	21,384	100	88
*N2MTG	*	19,809	106	93
*N2NYR	*	10,032	70	66
***K2CS**	**28**	**497,130**	**503**	**365**
*WA2BKN	*	24,700	167	52
*KA2ASU	*	14,800	87	80
*NY5C	*	10,740	70	60
*N2RKL/T	*	21	4	3
***KW2O**	**21**	**360,696**	**451**	**339**
			(Op: KS2G)	
KE3Q	**A**	**10,092,018**	**3602**	**1009**
K3ZO	**A**	**8,480,399**	**3173**	**943**
K2PLF	**A**	**2,911,458**	**1546**	**682**
KC3TL	*	1,582,796	1066	538
W3BGN	*	1,581,944	1054	533
N3HXQ	*	995,280	832	464
W3OU	*	63,627	159	127
KC3R	**28**	**5,647,638**	**2493**	**867**
			(Op: WA3FET)	
W3KLG	**28**	**220,968**	**304**	**264**
			(Op: K3ND)	
W3INK	*	60,480	155	140
AI3Q	*	8,109	59	51
N3LVO	*	4,080	43	40
K3CR	**21**	**5,576,375**	**2332**	**875**
			(Op: KB3AFT)	
***AA3E**	**A**	**5,028,426**	**2412**	**754**
			(Op: W3CF)	
***N1WR**	**A**	**2,451,735**	**1365**	**635**
***W2GG**	**A**	**1,464,272**	**1014**	**529**
*AJ3M	*	802,200	726	420
*KG2FH	*	630,420	643	395
*N3UM	*	304,777	391	269
*KE3VV	*	229,971	334	233
*N3WAV	*	41,500	155	125
*KE2G	*	34,980	128	110
*W3KM	*	32,550	117	105
*NN3SI	*	5,694	50	49
			(Op: WA4FXX)	
*N3ZEL	*	297	11	11
***W2BZR/3/T**	**28**	**559,398**	**634**	**399**
***W3CP**	**28**	**148,920**	**252**	**219**
*KA3GSS	*	9,291	61	57
KZ4XX	**A**	**8,401,272**	**3265**	**968**
			(Op: K4JNY)	
NV4X	**A**	**7,529,136**	**2976**	**908**
			(Op: K4MA)	
N4PN	**A**	**5,611,998**	**2435**	**861**
K4VUD	*	4,172,544	2110	768
WØYR	*	3,336,300	1765	674
WC4E	*	2,700,056	1559	668
NW6S	*	2,245,628	1301	634
KR4QI	*	2,201,888	1334	632
K4ZW	*	1,390,540	997	502
WR4F	*	1,073,709	869	483
W4GMM	*	1,011,264	802	458
W4NTI	*	688,364	616	382
W4YDY	*	447,888	500	336
NC4MI	*	349,554	460	298
N3RC	*	346,222	440	9
KE4OAR	*	229,080	341	249
N4GJ	*	204,330	320	245
N4MM	*	122,802	225	194
K4HSM	*	55,485	171	135
KØCOP/4	*	51,448	150	118
W4OGG	*	42,578	150	122
K4VV	*	35,420	122	110
W4UM	*	27,265	101	95
WA4MA	*	23,901	99	93
NY4A	**28**	**6,006,573**	**2642**	**877**
			(Op: W4ZV)	
WW4RR	**28**	**5,782,980**	**2675**	**843**
			(Op: K4WX)	
NJ4U	**28**	**5,438,784**	**2481**	**832**
KV4T	*	5,308,820	2423	818
WO4O	*	3,978,000	2067	750
			(Op: KØEJ)	
N4BP	*	2,724,104	1627	668
K4BAI	*	1,399,160	984	526
AG4W	*	945,980	743	466
W4YE	*	224,584	311	268
W1ENZ	*	117,975	230	195
KS4S	**21**	**197,880**	**303**	**255**
WK4R	**14**	**6,442,491**	**2735**	**991**
			(Op: K4XS)	
AA4MM	**1.8**	**56,448**	**237**	**147**
***N4IG**	**A**	**1,487,490**	**1014**	**537**
***KO4MM**	**A**	**1,448,966**	**993**	**514**
***N4NX**	**A**	**1,325,612**	**897**	**548**
*NA4K	*	510,152	531	344
*KG4BIG	*	499,008	545	339
*KU4FP	*	484,753	526	307
*K4OOO	*	442,224	512	332
*W4LC	*	433,640	485	296
*AK4ST	*	411,336	463	348
*K1DCB	*	409,118	511	337
*WA2CPP	*	317,322	420	289
*AA4KD	*	211,167	360	243
*K4IU	*	178,250	309	230
*N3ZYU	*	135,800	256	200
*N4UH	*	135,676	219	214
*KF4OAD	*	120,399	225	201
*N4JN	*	85,936	223	164
*WB4SQQ	*	84,240	198	162
*W4JDS	*	79,599	200	157
*AE4EC	*	73,839	170	163
*WB9BSH	*	72,850	176	155
*AJ4F	*	69,822	205	162
*K4WES	*	54,384	149	132
*KS4JB	*	31,654	114	98
*NB3O	*	11,470	65	62
*K1SO	*	2,025	27	27
***N4SEA/T**	**28**	**801,614**	**679**	**439**
***KC4UCK/T**	**28**	**180,509**	**299**	**241**
*W4TD	*	134,820	253	210
*KF4KSN/T	*	92,004	280	123
*W9CNF/M4	*	23,250	99	93
***W4TDB**	**14**	**12,308**	**71**	**68**
K5TR	**A**	**8,329,828**	**3495**	**988**
KZ5D	**A**	**5,736,192**	**2630**	**896**
K5ZO	**A**	**4,959,318**	**2254**	**879**
N5RZ	*	3,925,556	2015	787
WXØB	*	3,619,217	1898	757
			(Op: OH7WV)	
N5JR	*	3,456,102	1770	751
KE5OG	*	1,946,004	1431	631
N5ZK	*	775,072	680	457
			(Op: W5ASP)	
N5DD	*	275,770	359	253
N1QXV	*	107,559	219	171
KZ5MM	**28**	**5,846,792**	**2721**	**917**
K5RX	**28**	**5,441,294**	**2421**	**851**
WU3V/5	**14**	**1,311,570**	**1082**	**570**
			(Op: W5WMU)	
W5FO	**3.7**	**59,860**	**194**	**146**
***WD5K**	**A**	**3,323,214**	**1734**	**779**
***WA5IYX**	**A**	**919,056**	**835**	**467**
***N5PA**	**A**	**462,645**	**535**	**345**
*WK5K	*	384,370	513	323
*KM5QG	*	238,750	363	250
*N5PU	*	151,869	267	213
*KY5S	*	119,798	240	199
*NN5T	*	90,100	214	170
*WD5CNC	*	66,138	174	146
*K5VG	*	2,449	32	31
*K5RA	*	1,456	27	26
***KB5EKX**	**28**	**176,148**	**307**	**233**
***AC5SU**	**28**	**157,542**	**255**	**217**
*N5FPW	*	76,447	184	163
*WA5VKS/T	*	48,240	149	134
*W5CTV	*	43,173	136	123
*K5XY	*	12,212	75	71
***NN5Z**	**14**	**129,285**	**271**	**221**
			(Op: K5PX)	
*AD5Q	*	1	1	1
KZ6D	**A**	**8,538,300**	**3287**	**954**
			(Op: W6NL)	
AE6Y	**A**	**3,581,720**	**1938**	**755**
AK6R	**A**	**2,789,549**	**1939**	**721**
W6TK	*	2,273,645	1415	617
W6QEU	*	2,234,992	1438	656
NN6XX	*	1,657,060	1170	580
AI6V	*	1,547,800	1164	568
			(Op: K6GT)	
WW6O	*	1,027,712	806	496
W6IXP	*	992,842	785	467
K6III	*	896,368	808	463
KE6ZSN	*	857,394	755	414
KI6T	*	795,564	741	441
AG7W	*	676,002	728	366
			(Op: K6XX)	
W7CB	*	488,928	529	352
KG6AFS	*	443,552	602	334
			(Op: N6BZA)	
N6NF	*	332,044	470	323
K6ACZ	*	259,840	354	256
K6TV	*	237,258	390	269
NR3Y	*	233,550	379	270
N6VH	*	221,188	358	242
WK6LA	*	199,530	381	270
			(Op: K6LA)	
AJ6V	*	190,734	344	249
N6OPR	*	186,732	306	228
WM6A	*	78,870	207	165
			(Op: K6TA)	
N6IV	*	5,712	51	48
NN6NN	**28**	**3,327,128**	**2017**	**742**
NT6K	**28**	**2,783,190**	**1878**	**678**
W6AFA	**28**	**1,609,850**	**1151**	**550**
W6BSY	*	1,237,396	1035	527
N6HR	*	654,840	692	408
W6RWR	*	50,120	154	140
W6NK	**21**	**1,268,031**	**957**	**501**
WY6K	**14**	**1,808,381**	**1196**	**599**
W6RJ	**3.7**	**938,352**	**797**	**346**
W6VNR	**1.8**	**1,980**	**62**	**45**
***AA6PW**	**A**	**1,462,731**	**1040**	**493**
***NR6R**	**A**	**1,426,918**	**1114**	**562**
			(Op: K6AM)	
***W6PLJ**	**A**	**751,333**	**677**	**409**
*N6JM	*	664,678	607	394
*NI6FW	*	335,312	474	304
*AD6E	*	299,889	449	261
*W6SA	*	268,400	378	275
*WB6NFO	*	222,387	424	253
*KQ6MU	*	146,900	375	226
*KF6PKG	*	140,139	310	207
*K6BIR	*	119,040	249	186
*AD6G	*	117,120	248	183
*W6YL	*	115,560	246	180
			(Op: AD6E)	
*N6NG	*	99,710	204	169
*AA6EE	*	88,704	208	192
*K6CSL	*	67,821	194	141
*AD6Z	*	29,972	133	118
*KE6QR	*	29,561	123	103
*K6LDX	*	17,472	85	78
*N2ALE	*	3,569	50	43
***K6KAY/T**	**28**	**254,898**	**513**	**289**
***N6WLF**	**28**	**48,312**	**140**	**132**
*KD6PQF	*	38,586	139	118
*WF6O	*	2,628	73	36
*KC6OKU/T	*	1,121	20	19
***W6YJ**	**21**	**326,625**	**412**	**335**
***NP4IW/WX6**	**14**	**103,140**	**221**	**191**
*WR6WR	*	68,747	184	161
***KU6T**	**7**	**17,982**	**82**	**74**
K6LL/7	**A**	**7,226,691**	**3102**	**929**
K7RI	**A**	**6,830,340**	**2937**	**948**
WA7EQW	**A**	**4,152,720**	**2127**	**780**
K7ZZ	*	2,802,637	1692	697
W7WW	*	1,715,472	1249	594
K6TIM	*	634,848	613	389
KC7UP	*	628,680	610	403
W7QN	*	606,023	684	407
K7TR	*	569,030	633	385
KS7T	*	551,667	575	373
N7ZT	*	486,416	546	344
W7YS	*	133,744	255	208
KA7TDH	*	99,370	242	190
W7AYY	**28**	**271,872**	**355**	**78**
KD5YG/7	*	63,200	171	160
AD7J	**21**	**2,526,810**	**1417**	**715**
			(Op: W7FP)	
***WS7V**	**A**	**1,704,678**	**1191**	**606**
***W7YAQ**	**A**	**1,613,008**	**1059**	**584**
***WN7J**	**A**	**1,102,843**	**825**	**497**
*N7LOX	*	768,462	808	422
*N3AIU	*	256,272	416	281
*W7AVA	*	123,410	268	215
*NA7R	*	118,244	270	206
*KC7WUE	*	68,208	188	147
*W7HS	*	56,992	160	137
*KJ7CU	*	14,973	84	69
*W8FDV	*	420	15	14
***KG7EW**	**28**	**302,603**	**398**	**311**
***WJ7S**	**28**	**244,464**	**402**	**264**
*KE4GDQ/7	*	28,119	113	103
*AD7U	21	82,877	230	179
***AB7RW**	**14**	**8,968**	**61**	**59**
*KD7EJC	*	136	14	8
ND8DX	**A**	**4,477,815**	**2045**	**809**
K2UOP	**A**	**2,551,950**	**1437**	**642**
WO8CC	**A**	**2,201,258**	**1296**	**622**
			(Op: N8NR)	
WB8TLI	*	1,627,920	1087	532
AA8PA	*	1,558,984	1129	574
KB8QO	*	370,968	467	312
K8OQL	**28**	**237,982**	**342**	**257**
K3ZJ/8	*	201,803	313	227
KX8R	**21**	**7,556,250**	**2921**	**930**
			(Op: K8DX)	
***N8CN**	**A**	**1,425,375**	**1034**	**543**
***KI8CS**	**A**	**1,268,397**	**969**	**481**
***W8UPH**	**A**	**791,250**	**688**	**422**
*N8DXR	*	561,408	620	384
*KC8HWV	*	239,400	340	266
*W8VE	*	200,999	349	239
*K8CV	*	188,190	314	205
*AF8C	*	176,847	305	233
*KI8IZ	*	158,050	283	218
*N8WK	*	78,936	200	156
*WD8DJB	*	53,019	152	129
*N8WEL	*	33,912	129	108
*W8CK	*	11,109	75	69
***KC8MNO**	**28**	**137,292**	**240**	**204**
*N8WTH	*	13,064	75	71
***N8LIQ**	**7**	**15,232**	**64**	**56**
WB9Z	**A**	**8,893,312**	**3343**	**976**
KE9NA	**A**	**4,155,200**	**2042**	**784**
KI9A	**A**	**1,619,904**	**1081**	**572**
KF9YR	*	109,794	243	174
W9GIG	*	41,846	124	122
KG9X	**28**	**4,053,600**	**1951**	**800**
K9UQN	*	112,455	220	189
KK9A	**14**	**6,621,446**	**2603**	**962**
N9HCA	*	967,500	841	516
***K9OP**	**A**	**684,535**	**662**	**395**
***K9SH**	**A**	**352,024**	**441**	**316**
***WT9U**	**A**	**347,090**	**452**	**305**
*KB9KEG	*	321,195	423	285
*K9MMS	*	257,655	375	267
*KG9N	*	144,976	265	208
*K9JE	*	142,295	271	191
*W9YS	*	103,740	19	182
*KE9EX	*	494	13	13
***NN9K**	**28**	**829,545**	**705**	**435**
***N9GUN**	**28**	**454,494**	**462**	**359**
***KB9JIF/T**	**28**	**257,508**	**357**	**276**
*K9QC	*	197,847	299	247
*NG9L	*	131,670	231	209
*KJ9C	*	60,465	146	145
*N9NT	*	40,926	146	114
***KF9VJ**	**21**	**50,220**	**150**	**135**
***WD9DJD**	**14**	**5,616**	**50**	**48**
***KX9DX**	**3.7**	**81,829**	**299**	**173**
KØGAS	**A**	**1,394,925**	**1039**	**525**
KTØR	**A**	**1,179,350**	**895**	**515**
NØUU	**A**	**841,940**	**687**	**445**
WØOJYC	*	366,459	442	339
WØPPF	*	193,155	326	237
KVØQ	**28**	**4,735,980**	**2343**	**830**
KIØMB	**28**	**3,000,555**	**1691**	**655**
NP2N/AGØ	**28**	**1,122,240**	**843**	**501**
KØCAT	*	860,292	745	414
			(Op: K9WIE)	
K9NW	**21**	**4,347,252**	**2017**	**819**
AEØQ	*	317,934	431	306
NØAH	**3.7**	**272,816**	**393**	**236**
KØCS	**1.8**	**11,692**	**111**	**79**
***ACØW**	**A**	**2,988,441**	**1612**	**733**
***KW4T**	**A**	**1,359,720**	**989**	**540**
***KCØCN**	**A**	**899,346**	**809**	**437**
*KBØMZG	*	664,390	605	395
*NØNB	*	379,960	471	322
*KØDAT	*	186,000	289	248
*KB8QQF	*	154,176	261	219
*KAØZPP	*	116,991	226	189
*KBØWHY	*	113,400	218	200
*KIØLF	*	111,452	234	187
*NEØP	*	38,410	139	115
*KØRY	*	32,900	115	100
*W9UAL	*	8,532	57	54
*KCØFUD	*	2,407	31	29
*WRØBPU	*	595	18	17
			(Op: KØXM)	
***NØOFR**	**28**	**475,750**	**490**	**346**
***NØIBT**	**28**	**128,700**	**240**	**198**
*KAØZIA	*	52,826	142	122
*N9HDE	*	24,024	102	91

*KØUK	*	18,382	102	91	
*WIØWA	1.8	39,125	221	125	
					(Op: WØETC)

BARBADOS

8P6EX	A	969,252	809	444	
*8P2K	A	9,473,783	3603	979	

BAHAMAS

*C6AJZ	A	3,404,146	1942	698	
					(Op: WI9WI)

CUBA

*CO8TW	28	145,824	263	217

MARTINIQUE

*FM5DN	28	1,270,264	1070	488

ST. LUCIA

*J6/K5ZM	A	3,322,008	1791	666	
*J64AS	28	9,449,193	3982	949	
					(Op: N9AG)
*J68ID	21	1,738,716	1142	588	
					(Op: W8QID)
*J68TD	14	1,368,954	1021	502	
					(Op: KD4YHY)
*J68DD	7	17,380	55	55	
					(Op: N6JRL)

US VIRGIN IS.

KP2A	28	11,385,710	4243	1046	
					(Op: KW8N)
*NP2DJ	A	179,200	306	224	
*KP2BH	21	1,121,874	908	494	

PUERTO RICO

KP4KOE	28	50,820	164	140	
*WP4LNY	A	810,475	777	425	

COSTA RICA

*TI2/DL8UD	A	941,356	900	421

BELIZE

V31JP	A	10,319,660	3753	988	
					(Op: K8JP)
*V31RU	28	3,614,910	2035	713	
					(Op: N4MO)
*V31MX	21	436,320	503	360	

ST. KITTS

V47KP	A	9,921,683	3716	953
V44NK	14	475,308	547	324

CANADA

VA3UZ	A	9,026,416	3126	971	
VO1WET	A	4,020,792	2163	636	
VE5CPU	A	3,381,848	1744	722	
VE3OI	*	1,879,785	1171	555	
VE9MY	A	1,251,312	861	524	
VE7IN	A	1,220,112	1004	444	
VY2LI	A	1,050,090	775	435	
VA3SWG	*	758,190	663	398	
VE4IM	A	718,365	660	415	
VE7XO	*	314,368	406	256	
VE6YP	A	119,226	225	186	
VE7IO	*	70,854	173	147	
VE4RP	*	47,375	145	125	
VO1MP	28	7,158,144	3176	896	
VYØAA	28	6,428,384	2857	872	
					(Op: VE5RA)
VA2CO	28	550,020	531	356	
VE6JY	21	8,822,016	3179	1008	
					(Op: VE5MX)
VB7B	21	7,930,930	3047	959	
					(Op: VA7CW)
VE3HG	21	132,804	235	204	
VA7AM	14	2,265,885	1458	645	
VE1BY	3.7	2,226,300	960	492	
					(Op: K3BU)
*VE3EJ	A	8,811,015	3137	951	
*VE5SF	A	2,877,685	1606	685	
*VO1BC	A	2,111,587	1338	557	
*VE3STT	*	2,022,884	1185	566	
*VE2AWR	A	1,527,936	1044	519	
*VE6ZT	A	1,360,320	1034	520	
*VE3BUC	*	1,214,640	922	482	
*VO1GO	*	1,147,467	886	491	
*VE1OP	A	891,870	752	411	
*VE9WH	A	747,864	584	423	
*VE6EX	*	570,810	708	359	
*VA6SV	*	568,452	568	381	
*VE7JMN	A	430,902	535	333	
*VE2GWL	*	276,408	405	264	
*VE3YQY	*	273,050	400	254	
*VE4HAZ	A	28,119	100	91	
*VC7A	28	3,154,950	1895	675	
					(Op: VE7SV)
*VA6MA	28	2,250,012	1645	582	
					(Op: VE6MAA)
*VC4X	28	1,071,887	812	487	
					(Op: VE4VV)
*VE6BMX	*	1,068,777	1051	447	
*VE7NNN	*	1,066,220	1030	445	
*VA7DP	*	282,960	399	262	
*VE2SAI	28	143,349	257	213	
*VA7DX	*	124,960	270	176	
*VE2PIJ	*	1,064	19	19	
*VC3M	21	5,365,405	2325	839	
					(Op: VA3MM)
*VE3MQW	*	516,800	505	380	
*VE3OIL	*	412,794	449	342	
*VE6TP	14	347,928	407	327	
*VY2MGY/3	1.8	30,825	114	75	

BRITISH VIRGIN IS.

*VP2VF	28	2,752,000	1803	640	

TURKS & CAICOS

*VP5E	A	7,071,084	3181	843	
					(Op: K6HNZ)

MEXICO

*XE2AUB	A	1,565,472	1147	552
*XE2MX	A	1,176,145	883	505
*XE1BEF	*	962,550	775	414
*XE1MEX	14	52,380	150	135

AFRICA

MAURITIUS

*3B8MM	A	3,245,999	1679	647	
					(Op: DL6UAA)

TUNISIA

3V8BB	A	15,266,880	4327	1080	
					(Op: YT1AD)

ALGERIA

*5A23PA	28	225,929	361	209	
					(Op: 5A1A)

NIGERIA

5NØW	21	8,122,044	2921	931	
					(Op: OK1RK)

GHANA

9G5ZW	28	10,954,800	3604	1020	
					(Op: OK2ZW)

MOROCCO

*5C8A	21	2,153,388	1293	556

MADEIRA IS.

CT3BX	A	14,185,305	4210	1059	
CT9KN	A	5,315,912	2285	764	
*CT3KY	14	22,440	90	85	

CANARY IS.

AN8BAY	A	323,568	394	252

EA8AH	28	14,567,148	4365	1116	
					(Op: OH1MA)
*EA8AG	28	758,844	651	394	

CUETA & MELILLA

*EA9AR	A	420,525	430	315

ETHIOPIA

*9E1C	14	1,785,525	1118	537	
					(Op: IV3OWC)

EGYPT

*SU9ZZ	A	9,809,304	3524	904

MALI

TZ6DX	28	2,048,920	1214	566	
					(Op: K4RB)

SOUTH AFRICA

ZSØE	A	81,120	178	156	
ZS6HO	*	10,320	60	60	
*ZS9P	A	333,828	408	281	
					(Op: ZS6PHD)
*ZS6AVP	*	101,062	200	169	

ASIA

VIETNAM

*3W2GAX	14	310	11	10

ISRAEL

4Z1GY	A	1,773,055	1279	505	
4X2K	14	1,449,123	1044	509	
					(Op: 4X1RF)
*4XØF	A	403,845	465	327	
					(Op: 4Z5FL)
*4X1VF	28	181,482	300	203	
*4X6DK	*	41,265	133	105	
*4Z8DX	21	3,492,918	1660	767	
					(Op: 4Z4DX)
*4Z5FW	*	333,266	400	281	
*4Z5FI	7	7,326	39	37	

CYPRUS

C4A	A	11,745,600	3959	960	
					(Op: 5B4ADA/9A3A)
H22H	28	9,092,146	3686	931	
					(Op: 5B4MF)
5B4LP	14	5,263,200	2301	816	

KUWAIT

9K9A	21	1,232,870	928	485	
					(Op: 9K2AI)

MALAYSIA

*9M2TO	A	596,772	836	396	
					(Op: JAØDMV)
*9M2JI	28	63,474	330	142	

SINGAPORE

9V1RH	A	41,360	132	110
*9V1BG	A	238,140	394	270
*9V1XE	*	23,580	105	90
				(Op: VK3DXI)

TAIWAN

*BV2TL	A	215,808	574	256
*BV7FF	21	376,320	770	336

PEOPLE'S REP. OF CHINA

*BD6RD	A	136,533	410	213
*BA4EG	28	242,223	440	263

PALESTINE

E41/OK1DTP	A	2,392,210	1508	565	

ARMENIA

*EK6TA	28	1,620,791	1271	491	

KYRGYZSTAN

EX8W	A	7,546,795	3131	905	
EX8MDA	*	641,600	607	400	
*EX2T	A	2,733,666	1550	606	
*EX8MIO	28	627,760	784	380	
*EX7ML	*	348,984	480	296	
*EXØY	21	1,431,490	1115	557	

KOREA

*HL1/JL1EFP	A	126,000	385	180	
*HL5UOG	*	48,438	154	117	

SAUDI ARABIA

HZ1AB	A	3,823,434	1894	683	
					(Op: SMØCXU)

JAPAN

JH7PKU	A	10,011,300	3577	975	
JM1XCW	A	4,385,089	1952	751	
JI2KVW	A	3,412,728	1727	682	
JAØQWO	*	3,074,922	1654	666	
JA2BNN	*	3,023,060	1660	668	
JA2FSM	*	2,349,312	1377	608	
JR1LEV	*	766,115	660	413	
JG3VEI	*	408,555	472	315	
JG7AMD	*	282,846	362	282	
JA5ATN	*	262,615	370	265	
JF2FIU	*	259,259	361	259	
JH2QAI	*	243,892	321	241	
JH1CTV	*	153,266	290	197	
JA1KAL	*	152,434	300	199	
7J1ABD	*	140,844	245	194	
JA6BGA	*	81,090	184	153	
JA2CWU	*	79,618	185	154	
JA5GSG	*	76,824	110	99	
JA8TEZ	*	70,000	181	140	
JA3ARM	*	58,320	158	135	
JA3HBF	*	50,400	150	126	
JR1JCB	*	26,402	101	86	
JJ1JRH	*	14,819	77	73	
JA2QVP	*	7,344	50	48	
JG3WCZ	*	867	17	17	
JA5BJC	28	5,915,496	2491	824	
JR6EZE	28	5,645,346	2367	834	
JH6AUS	28	2,871,648	1496	676	
JR7RJZ	*	385,088	412	352	
JH1OAI	*	354,200	390	322	
JR3CVO	*	136,305	233	195	
JA1ANA	*	30,800	104	100	
JA1AAT	*	22,932	92	91	
JR1MQT	21	1,434,804	983	532	
JH7QXJ	21	742,652	668	401	
JA5APU	*	347,831	411	307	
JA4DPL	*	74,734	179	158	
JH1FNU	*	53,064	148	132	
JQ1AHZ/2	*	11,718	81	63	
JE3BMU	*	10,498	61	58	
JA1XEM	*	9,396	60	54	
JH1BUB	*	8,096	69	46	
JA6ZPR	14	414,400	477	320	
*JL1ARF	A	3,833,150	1745	775	
*JF1SQC	A	2,043,030	1194	615	
*JA9SCB/1	A	1,305,808	910	524	
*JQ1UXN	*	1,253,051	895	487	
*JS1OYN	*	1,178,053	877	487	
*JA5EO	*	1,162,130	879	463	
*JI3BFC	*	1,110,200	828	488	
*7K4GUR	*	1,107,400	785	490	
*JQ6NAW	*	896,210	689	434	
*JAØBMS/1	*	742,560	674	416	
*JN3SAC	*	721,000	644	412	
*JG1OWV	*	548,628	545	349	
*JA2BQX	*	534,600	558	360	
*JA4KTE	*	493,968	531	328	
*JH6OPP	*	401,322	456	317	
*JA1XRH	*	353,612	428	292	
*JH6TYD	*	342,953	407	299	
*JE1UFF	*	309,943	407	281	
*JR1MRG	*	307,800	423	270	
*JA1BUI	*	303,303	411	303	
*JE1REU	*	285,782	400	274	
*JJ3TBB	*	278,517	400	263	
*JA2GHP	*	239,904	355	252	
*JHØIXE	*	229,471	341	253	
*JO3JYE	*	194,250	304	222	
*JA2BEY	*	192,885	312	231	
*JEØUXR	*	185,232	277	227	
*JR1LQK	*	164,280	270	222	
*JF2SKV	*	155,236	281	197	
*JM3XEJ	*	147,900	278	204	
*JA1KK	*	143,280	258	199	
*JGØOXL	*	115,840	226	181	
*JH2WHS	*	105,608	222	172	
*JH6FTJ	*	101,996	223	172	
*JL3RDC	*	72,141	201	139	
*JE8KXX	*	64,656	173	144	
*JA1XPU	*	57,856	159	128	
*JJ3QXW	*	56,172	151	124	
*JH5OXF	*	52,877	144	121	
*JHØNEC	*	43,407	145	117	
*JA7ARW	*	43,078	136	119	
*JI2VLM	*	39,060	134	105	
*JK1ASO	*	37,492	123	103	
*JR3NDM	*	37,418	135	106	
*7L4PWR	*	36,740	135	110	
*JH1RDU	*	24,960	96	93	
*JAØGEY	*	24,208	94	89	
*JG3NKP/1	*	22,176	92	84	
*JH2IJC	*	20,750	86	83	
*JM4UZM/4	*	20,418	100	83	
*JE1SLP	*	9,100	55	50	
*JK8HOS	*	6,272	52	49	
*JA9EJG	*	4,284	40	36	
*JEØVFV	*	4,104	50	36	
*JN7XQN	*	2,074	39	34	
*JF7GDF	*	1,472	24	23	
*JA1EIS	*	1,386	22	21	
*JA1STY	*	850	18	17	
*JL4OND	*	572	26	22	
*JA7BEW	28	3,240,334	1585	718	
*JF3BFS	28	1,906,410	1164	583	
*JA6WFM	28	1,003,572	801	457	
*JM4WUZ	*	733,460	660	403	
*7J7ACZ	*	662,890	554	439	
*JE7DOT	*	339,748	403	314	
*JA6EFT	*	287,100	350	290	
*JA1BBA	*	241,434	322	263	
*JH1CML	*	166,036	271	206	
*JA1VVH	*	151,790	262	215	
*JA4BAA	*	140,456	260	194	
*JF3IYW	*	104,155	221	185	
*JJ3APB	*	101,851	212	179	
*JA6QDU	*	95,247	193	171	
*JA7KM	*	57,951	153	137	
*JA1ALX/9	*	54,780	149	132	
*JA1EEG	*	50,310	144	129	
*7N2UQC	*	47,628	138	126	
*JH1RMH	*	40,470	125	114	
*JG2VSF	*	37,791	118	117	
*JK7QYZ	*	29,100	109	100	
*JR2TRC	*	21,590	90	85	
*JA3BBG	*	19,926	85	82	
*JR1WYV	*	14,022	122	41	
*JP6AAW	*	13,317	72	69	
*JA3KDJ	*	11,682	76	59	
*JHØSGG	*	7,056	144	49	
*JH1TUX	*	4,756	44	41	
*JQ3UDL	*	972	18	18	
*7K2PBB	*	560	17	16	
*JH4XWU	*	297	11	11	
*JG7PSJ	21	1,967,458	1136	631	
*JR3RIY	21	1,381,357	911	551	
*JL3VUL/3	21	1,078,462	786	517	
*7J7ADB	*	136,479	269	201	
*JI8BUR	*	58,519	161	139	
*JR7LVK	*	55,308	151	132	
*JI8GZS	*	44,125	139	125	
*JA4JJI	*	35,510	127	106	
*JA2XOA	*	17,696	96	79	
*JH2BTM	*	15,695	81	73	
*JK1BII	*	11,088	74	63	
*JA7ADV	*	9,700	62	60	
*JGØGGI	*	5,310	48	45	
*JR3KAH	*	3,744	44	39	
*JR1BSV	*	3,366	39	34	
*JJ2SHW	*	2,880	32	30	
*JK8FRL	*	1,890	28	27	
*JG1GCO	*	645	15	15	
*JM3HYL	*	462	18	14	
*JQ6QKM	*	360	12	12	
*JHØEPI	14	73,164	181	156	
*JH1UUT	14	25,175	97	95	
*JE1GZB	*	4,095	39	39	
*JG3EHD	*	189	9	9	
*JA1KVT	7	20,992	71	64	
*JE1SPY	3.7	1,975	25	25	
*JE4MHL	*	6	1	1	

OGASAWARA

*JD1BIA	A	76,934	318	143	

JORDAN

JY9NX	A	11,000,096	4056	907	
					(Op: JM1CAX)
*JY9NE	A	381,210	450	291	

LEBANON

OD5/OK1MU	14	3,546,108	1811	719	

ASIATIC RUSSIA

UAØJDD	A	201,348	369	238	
UAØAGI	*	24,000	100	96	
UAØCW	*	976	19	16	
RSØF	28	4,008,204	1798	801	
					(Op: UAØFZ)
RVØAR	21	4,484,480	1960	880	
UAØWW	21	1,201,354	1002	538	
*RAØFF	A	2,818,102	1652	707	
*UAØSJ	A	1,158,346	870	527	
*UAØANW	*	699,933	631	411	
*RUØAT	*	198,654	311	226	
*UAØZDA/MM	*	197,448	333	228	
*UAØJB	28	1,961,600	1195	640	
*UAØFDX	21	1,293,258	1094	527	
*UAØWGD	*	192,720	344	240	
*UAØAPP	*	67,711	191	173	
RW9HA	A	4,949,113	2451	793	
RV9SB	A	1,480,024	876	532	
RV9SV	A	1,475,056	1003	493	
RZ9CX	*	712,920	663	390	
UA9LAC	*	668,868	611	401	
RK9AD	*	382,162	450	319	
RZ9AWO	*	358,470	444	315	
					(Op: UA9AM)
RA9DZ	*	157,976	259	217	
UA9KM	*	142,308	259	201	
RV9JD	28	163,213	280	227	
UA9OUB	28	162,603	282	203	
RA9AC	*	6,400	50	50	
UA9BS	14	215,303	315	253	
UA9AM	7	384,930	315	235	
*RN9RZ	A	1,537,920	1029	534	
*UA9JLZ	A	1,196,415	915	495	
*RA9DA	A	1,098,972	773	441	
*RW9QA	*	593,285	600	335	
*UA9ORQ	*	409,820	464	310	
*RA9XF	*	375,962	452	317	
*RW9RF	*	308,736	413	268	
*RK9JWV	*	122,718	241	181	
*UA9AX	*	86,140	189	146	
*UA9JMB	28	1,096,488	872	471	
*RAØCCJ/9	28	620,299	676	373	
*UA9JPK	*	471,099	498	373	
*RZ9UC	21	2,240,100	1462	684	
*RV9JR	21	1,239,885	897	531	
*RJ9J	14	2,443,920	1212	680	
*RA9CZ	*	1,800	25	24	
*RA9JP	7	70,596	134	106	

UZBEKISTAN

UK9AA	A	329,613	400	281	
*UK8IG	A	735,050	561	482	

KAZAKHSTAN

UP4L	A	5,666,658	2355	841	
					(Op: UN7LZ)
UPØF	28	1,218,854	1014	481	
					(Op: UN7FK)
*UP5P	A	5,406,314	2270	853	
					(Op: UN5PR)
*UN9FD	*	162,216	285	216	
*UP6F	28	1,576,827	1155	567	
					(Op: UN7FZ)
*UN7D	*	757,068	837	422	
					(Op: UN7DA)
*UN9LN	21	47,916	146	121	

INDIA

VU3VLH	A	5,651,055	2712	765	
					(Op: OK1MM)
*VU3DJQ	14	11,832	68	68	

MACAU

XX9TRR	A	6,150,816	3150	864	
					(Op: OH2PM)
*XX9AU	21	29,304	192	111	

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SYRIA

*YI9OM	28	1,319,625	1055	425

EUROPE

UNITED NATIONS AUSTRIA

4U1VIC	A	4,313,568	2362	784

CROATIA

9A2RD	28	1,600,082	1181	514
9A5Y	21	4,483,206	2136	897
9A4X	7	796,572	671	406
*9A2YC	A	1,319,240	1036	559
*9A6ACY	A	775,536	720	453
*9A4SS	*	676,460	611	454
*9A3ZO	*	15,486	105	89
*9A5V	28	1,804,968	1380	516
*9A2TX	*	45,539	137	113
*9A8C	1.8	70,518	222	161
			(Op: 9A2HI)	

ANDORRA

*C35LJ	A	506,730	680	399

PORTUGAL

CT1GPQ	A	587,880	677	426
CT8T	28	7,598,070	3241	963
			(Op: CT1ESV)	
CQ1BOP	21	6,989,997	3229	1029
CT1AOZ	14	2,565,150	1714	735
CT1BNW	*	198,900	380	306
*CT1AFC	A	160,560	324	223
*CT1ELF	*	112,944	281	208
*CS7GTP	28	421,056	541	387
*CT2GZT	*	12,450	80	75
*CS8EGW	21	1,394,032	1100	604
			(Op: CT1EGW)	
*CT1CAK	*	75,819	206	199
*CT4NC	14	68,688	160	144
*CT2GBK	7	9,864	80	36

GERMANY

DJ6QT	A	4,614,660	2307	827
DJ5BV	A	2,235,120	1440	695
DF6QV	A	1,843,170	1312	655
DJ8UV	*	1,739,694	1351	613
DL9DYL	*	1,309,984	993	536
DJ9MH	*	1,161,484	1018	556
DL6DCX	*	1,081,832	900	499
DH1TST	*	495,110	614	385
DL1PT	*	337,280	434	340
DL6AG	*	328,600	458	310
DL6DVU	*	223,312	424	272
DF3IS	*	151,728	325	232
DH1NHI	*	46,512	173	136
DJ1MM	*	35,462	144	119
DN1MA	*	20,202	101	91
DK5KJ	*	19,872	207	96
DL8SDI	*	10,349	95	79
DL7UHD	*	2,379	42	39
DF5AU	*	1,064	20	19
DL2HBH	28	2,655,488	1500	704
DK2OY	28	1,506,978	1100	531
DK3KD	*	423,720	503	330
DL6UNF	*	207,104	310	809
DF9ZP	*	150,750	314	201
DK7AN	*	51,408	152	136
DL8PC	21	1,677,455	1117	655
DK8LV	21	442,680	570	357
DL1TC	*	173,328	290	276
DJ7AA	14	7,955,224	3162	1052
DJ2YE	7	34,270	125	115
*DL6RAI	A	1,389,525	1161	573
*DK6BT	A	1,000,152	870	522
*DL1MGB	A	763,504	815	476
*DK3DM	*	720,128	771	464
*DF2FM	*	675,108	678	423
*DL3ZAI	*	673,959	752	429
*DH8AF	*	654,048	650	432
*DK5DS	*	428,980	549	356
*DL8SDC	*	378,744	501	344
*DH2PL	*	364,026	547	338
*DL2VB	*	343,116	500	324
*DL8AKA	*	321,280	446	320
*DL1LSZ	*	273,280	429	305
*DL6AKK	*	270,774	450	294
*DL2FAG	*	261,326	400	299
*DK7ZH	*	234,065	400	277
*DL8ULO	*	194,883	401	263
*DL2GBB	*	186,702	334	253
*DH2PG	*	185,402	381	266
*DJ2UB	*	179,172	339	252
*DL9NEI	*	176,045	313	257
*DK6AY	*	144,145	336	227
*DL4JYT	*	119,599	276	199
*DF5PK	*	85,188	243	186
*DF5PP	*	84,180	310	138
*DLØBBG	*	70,400	302	160
(Op: DL3HSC)				
*DL3KDC	*	54,872	194	152
*DL5CX	*	13,398	75	69
*DF5RF	*	7,035	73	67
*DK7FP	*	4,140	39	36
*DH7RD	*	2,678	39	26
*DL1SBF	*	1,960	30	28
*DL3AG	28	326,126	421	318
*DA1BT	28	224,370	350	277
			(Op: DL4VCW)	
*DL3NBL	*	109,011	235	203
*DL1FMG	*	47,422	167	131
*DM3XI	*	22,270	92	85
*DJØBX	*	17,064	86	79
*DA1SP	*	2,800	36	35
			(Op: DL4VCP)	
*DL5ANS	*	1,600	26	25
*DLØXX	*	325	13	13
*DA1LDN	21	358,428	506	357
			(Op: ON4LDN)	
*DL3BRA	21	241,101	400	301
*DKØNDR	14	633,600	750	495
			(Op: DL8GCS)	
*DF7YU	14	480,249	655	441
*DL4VBS	3.7	25,308	139	111
*DL2RZG	1.8	882	21	21

SPAIN

EA5DFV	A	2,428,188	1582	633
EA2CLU	A	1,785,187	1197	607
AM3DUW	A	1,318,112	1353	544
AN1FBU	*	1,173,916	1170	538
			(Op: EA1FBU)	
AN5DCL	*	1,097,876	1115	559
AN1OT	*	412,400	610	400
AN5GMB	*	337,674	511	337
EA7HCU	*	310,772	506	308
AN1FFC	*	290,745	402	355
EA4BSC	*	111,804	301	231
EC3AHT	*	91,080	250	198
AN5CMQ	*	69,190	200	185
EA1BLX	*	30,923	124	107
EA5FKX	*	26,416	112	104
EA1IF	*	6,608	62	56
AM3ATM	28	4,250,834	2176	791
AN7HBP	28	1,506,000	1376	600
AM1JJ	28	1,450,920	1187	535
EA3DUZ	*	292,974	371	302
EA3GHQ	*	203,376	337	228
AN1CQJ	*	129,204	296	222
AN2BP	*	72,842	213	154
AM1AAA	*	39,000	133	130
EA1BZP	*	18,183	95	87
AN4KD	21	2,885,337	1843	819
			(Op: EA4KD)	
EA3QP	21	1,532,096	1202	647
EA5GRB	21	1,123,899	771	491
EA1JO	*	506,177	635	433
EA2KV	*	55,706	205	173
EA3GEP	14	1,004,960	1087	571
EA7ATX	*	769,538	870	526
AN2CRG	3.7	416,223	529	309
EA1AUT	*	31,290	132	105
*AN7RU	A	1,996,904	1504	676
*AN3GEG	A	1,566,432	1303	588
*EA1BPO	A	1,293,816	1140	564
*AN1DAX	*	1,253,160	1172	590
*AN1AJV	*	1,155,336	1185	552
*EF3AGC	*	1,139,401	1134	547
*AN4BFK	*	1,027,416	728	481
*AM5EOR	*	901,476	904	491
*AN7AFM	*	865,032	993	532
*AN3ASS	*	663,080	663	484
*AN1ET	*	560,616	736	426
*AM1YB	*	552,594	682	413
*AN7BJV	*	377,571	605	381
*AM1AUM	*	364,356	555	349
*AN1DBC	*	305,905	486	317
*AM5AJX	*	249,162	443	317
*AN7OO	*	248,320	535	320
*AN2BNU	*	247,104	430	288
*EA5QB	*	222,750	392	275
*EA7AJR	*	190,784	369	271
*EA1AE	*	167,919	335	251
*EA5ATK	*	121,360	230	205
*EA3AAW	*	110,175	263	195
*AN4EMC	*	106,855	264	215
*EA5FEJ	*	91,014	230	197
*EA3DVJ	*	86,592	231	192
*EC4AIH	*	85,215	260	195
*EA3DTQ	*	67,093	208	169
*EA1GL	*	63,180	205	162
*EA5FWW	*	55,890	158	135
*AN5IT	*	53,573	267	169
*EA1BAW	*	47,704	154	134
*EA1RH	*	37,940	169	140
*EA2AVM	*	31,857	121	111
*EA3NA	*	27,839	117	97
*AN1HF	*	22,008	100	84
*EA5CRU	*	21,114	112	102
*EA7TG	*	20,493	114	99
*EA7BBB	*	17,177	101	89
*AN7KY	*	13,490	75	71
*AN7CA	*	12,480	83	78
*EA3AGB	*	8,008	56	52
*EC7AMD	*	8,004	82	69
*EA6JN	*	6,188	75	52
*EA2BVN	*	5,002	66	61
*EC1ALY	*	3,478	38	37
*AN5GCV	*	2,052	28	27
*AM7FTR	28	2,105,130	1614	705
*AN5DFX	28	1,240,200	1058	585
*AN3FCQ	28	1,077,380	924	515
*AM1MK	*	661,716	719	396
*ED6TC	*	321,280	483	320
*AN7AKJ	*	300,699	481	333
*AN1ATQ	*	298,803	433	309
*AM3ALV	*	247,572	370	299
*AN5AAJ	*	191,520	327	266
*AN1GA	*	46,053	207	153
*AN5WX	*	45,920	150	140
*EA1CXH	*	23,219	115	107
*AN4KN	*	22,680	120	105
*AM5DIT	*	20,094	107	102
*EA1CGC	*	5,328	50	48
*EC1CGI	*	1,320	22	22
*AN7ANM	21	446,479	747	407
*EC5CON	21	427,392	717	384
*AN5UN	21	307,304	528	359
*EF7AKQ	*	122,452	506	242
*EF3ALV	*	93,740	325	215
*EC4AGQ	*	70,670	240	191
*EA7FRX	*	60,570	180	162
*EC7DNE	*	41,500	166	166
*EF4CUV	*	35,862	212	139
*EA4DKS	*	20,169	87	81
*EF3PL	*	12,710	99	82
			(Op: EC3CMT)	
*EC4DFA	*	5,740	73	70
*AN5TN	*	2,068	108	101
*AN3CT	14	232,170	516	327
*EA3CZR	*	33,880	152	140
*EA2CND	*	15,225	89	87
*EA2CHL	*	13,100	109	100
*EA3AHS	7	5,916	54	51
*AN3FNI	*	3,078	40	38
*EA7HE	*	24	4	4

BALEARIC IS.

AN6AEQ	A	2,532,816	1630	738
*AN6LP	A	185,496	380	262
*EA6ABK	*	4,232	46	46
*EA6ACF	28	52,055	175	145
*EA6EA	*	1,265	23	23

IRELAND

EI4DW	A	2,905,104	1764	696
*EI4CF	A	584,400	667	400

MOLDOVA

ER1IM	14	184,600	397	284
*ER6A	A	887,348	966	473
*ER1BF	*	22,620	102	87

ESTONIA

ES6PZ	A	1,067,744	996	488
ES1BH	*	174,445	358	251
ES5RIM	*	49,833	158	147
ES4RD	14	725,829	797	481
*ES6RHT	A	155,414	318	238
*ES1ABR	28	238,524	370	278
*ES6CO	28	238,235	335	265
*ES5TX	*	143,594	266	214
*ES5RGJ	*	75,264	191	168
*ES5CX	21	15,862	118	103

BELARUS

EU5A	A	1,170,115	1007	545
			(Op: EU4AB)	
EW5O	A	1,075,368	1126	518
EW2AA	*	177,390	304	219
EU1PA	*	49,350	173	141
EU1SA	21	164,346	377	258
*EW6GF	A	60,844	214	164
*EW6DF	28	139,084	277	218
*EW1AAV	*	13,720	84	70
*EU4EU	21	36,540	145	126
*EW4EW	14	58,512	220	184
*EW1NA	*	47,012	160	146
*EU6TT	*	192	12	12
*EW8DX	3.7	243,810	423	258

FRANCE

F5RZJ	A	5,245,130	2414	902
F6FYD	A	738,840	767	470
F5UTN	*	707,544	603	372
F5TYY	*	90,132	230	174
F6KDF	28	3,592,304	1915	752
F5LBL	28	859,024	800	424
F5AOV	*	600,780	562	465
F6HMQ	21	3,403,194	1787	771
*F5NBK	A	352,796	506	356
*F8BJI	28	322,792	410	314
*F8CNR	28	253,328	366	284
*F5JY	*	135,240	262	230
*F6FTB	*	18,249	89	77
*F6KUF	21	1,366,200	1074	550
*F5OZK	*	154,575	350	229
*F5BEG	3.7	376,671	519	309

ENGLAND

G4BUO	A	202,030	339	227
G3UYF	*	6,525	49	45
GØAEV	28	3,597,216	1864	742
G4WTD	28	2,298,824	1464	604
*MØBRK	A	1,339,624	1163	572
*GØKRL	A	1,105,864	1012	548
*MØCQS	A	823,680	877	480
*G3VAO	*	761,960	843	430
*MØAFC	*	647,197	692	437
*GØNWY	*	456,760	600	380
*MØBEX	*	285,123	477	303
*GØVBD	*	210,630	356	255
*G3VQO	*	144,942	327	238
*M5ACC	14	1,734,202	1635	674
*M4T	*	119,850	350	255
			(Op: GØVQR)	

SCOTLAND

GM3BCL	A	686,512	735	428
GM7V	28	8,305,756	3272	982
			(Op: GM4YXI)	

WALES

*GW3NJW	A	164,920	300	248
*GWØAJI	21	194,679	403	291

HUNGARY

HAØDU	28	4,134,026	2006	799
HG3DX	21	4,287,290	2124	839
			(Op: HA3UU)	
HG9X	7	2,541,605	1199	605
			(Op: HA9AX)	
HG3M	3.7	1,426,355	1036	491
			(Op: HA3MY)	
*HAØIT	A	2,825,900	1782	734
*HA9MDP	A	934,520	914	488
*HA3LI	*	396,288	513	344
*HA4YO	*	96,150	263	195
*HG9VHF	28	322,004	410	316
*HA6IAM	*	130,368	260	194
*HA8IH	14	510,064	702	449
*HA3GN	*	82,857	314	213
*HA/YT7BR	7	78,352	212	166

SWITZERLAND

HB2CIC	A	870,716	776	514
			(Op: HB9CIC)	
HB2AAA	A	851,904	700	493
HB9FBS	3.7	204,204	401	238

ITALY

IR2W	A	9,162,675	3608	965
			(Op: I2VXJ)	
IK4MTF	A	4,671,975	2346	809
IQ6T	A	2,442,710	1587	685
IK4AUY	*	2,206,464	1439	676
IK6JNH	*	2,133,558	1066	574
IK6GPZ	*	274,032	400	264
II4A	*	223,860	430	273
			(Op: IK4ADE)	
IZØBPI	*	121,581	309	237
IQ2X	*	113,712	237	206
			(Op: IK2GZU)	
IQ4A	28	7,782,070	3158	941
			(Op: IK2NCJ)	
IZ5AXA	*	276,351	411	251
I1QBI	*	53,508	155	147
IZØAIS	*	40,376	145	103
IU2P	21	3,494,751	1929	793
IQ3A	14	6,279,179	2765	977
			(Op: IV3TAN)	
IR4R	14	1,783,404	1434	674
IU2C	*	523,089	747	437
IQ3X	3.7	396,836	580	311
			(Op: IV3SKB)	
IK1ZOY	1.8	40	5	4
*IQØA	A	733,326	808	451
			(Op: IKØXBX)	
*IK2SAI	A	693,498	753	442
*IZ7CDB	A	675,510	699	445
*II3L	*	415,863	657	369
			(Op: IV3KAS)	
*IKØWHN	*	383,643	546	351
*IK2BCP	*	213,444	331	252
*IK3CXG	*	198,390	372	255
*IK6UBY	*	128,061	313	243
*IK2WYI	*	114,904	273	212
*IZ2ABN	*	96,015	219	173
*IK8IFW	*	70,252	245	193
*IZ2DAY	*	57,768	236	166
*IK1ZOF	*	56,560	163	140
*IK5ZTT	*	49,120	188	160
*IUØK	*	41,600	140	128
			(Op: IKØSTM)	
*I8TWB	*	41,076	170	126
*IK2WZQ	*	30,018	120	106
*IV3KSE	*	22,413	100	93
*IZ4AQL	*	20,200	110	101
*IN3PEE	*	16,910	112	95
*IZ6BYO	*	13,694	100	82
*IK2WFN	*	5,704	50	46
*I/OH2BAH	*	1,950	45	30
*IZ4AKS	*	5,356	53	52
*IU1W	28	1,219,414	950	541
			(Op: I1WXY)	
*IK4QJM	28	443,669	520	361
*IK5YJK	*	204,255	335	267
*IK2YSA	*	175,436	302	244
*IK6VXO	*	164,430	275	203
*IR3T	*	113,967	240	201
			(Op: IV3AJZ)	
*IZ3ALS	*	336	12	12
*I7FMN	21	214,900	428	307
*IK4CBM	14	3,348	64	62
*IV3RCH	3.7	5,546	53	47

SARDINIA

ISØNHT	28	57,450	203	150
*ISØIGV	A	330,672	499	332
*ISØLLJ	*	51,770	174	155

SICILY

IT9RYJ	21	824,780	1004	506
*IT9VCE	A	292,744	500	344
*IT9OJW	*	221,265	421	297
*IT9JOF	*	200,605	350	265
*IT9ICS	14	1,320,660	1210	580
*IT9TPA	*	45,210	202	165

NORWAY

LA8W	A	8,304,840	3225	1020
			(Op: LA8SDA)	
LA4EU	*	154,114	362	251
LA7NFA	*	8,500	57	50
LA9HW	21	3,358,578	1803	786
LA5UF	*	528,766	708	422
LA6WEA	1.8	58,098	203	138
*LA3BO	A	196,840	454	280
*LA7TN	*	118,048	313	224
*LA2MJA	28	423,600	510	353
*LA5KO	*	168,459	303	233
*LA4GIA	21	361,515	385	313
*LA2WIA	*	100,580	256	214
*LA9AU	*	36,575	161	133

LUXEMBOURG

LX9EG	28	4,160,835	2161	765
LX4B	28	1,182,156	969	516
			(Op: LX1KQ)	
*LX1JH	A	608,424	662	404
*LX7I	7	499,106	695	326

LITHUANIA

LY7Z	A	8,340,624	3290	1032
			(Op: LY2TA)	
LY2IJ	A	5,020,306	2431	857
LY3BH	A	4,389,798	2230	798
LY2OX	*	1,218,016	1029	544
LY1ØZZ	28	4,632,075	2274	765
			(Op: LY3MM)	
LY1CX	28	1,097,257	931	457
LY2OU	*	1,093,500	905	486
LY2GF	*	945,625	859	425
LY1DT	21	1,866,266	1342	667
LY6K	7	827,640	714	396
LY3BX	*	399,105	460	315
*LY2BM	A	2,182,306	1502	679
*LY2LA	A	1,484,682	1186	582
*LY2DX	A	1,221,792	1136	534
*LY2TZ	*	343,311	583	361
*LY1ØFW	*	146,972	276	203
*LY1DM	*	75,753	443	171
*LY2AT	28	91,998	226	171
*LY5W	*	15,614	91	74

BULGARIA

LZ6A	A	2,462,460	1735	715
			(Op: LZ4BC)	
LZ5QZ	A	1,802,556	1600	622
LZ1BJ	*	713,377	864	457
LZ1BG	*	44,541	172	147
*LZ2AU	A	245,680	430	296
*LZ1DM	A	206,640	402	280
*LZ2FN	A	149,537	307	229
*LZ1NJ	*	90,090	61	45
*LZ2RF	*	63,720	207	135
*LZ5AZ	*	50,844	340	286
*LZ2MP	*	34,916	143	116
*LZ4BU	*	10,890	70	66
*LZ1FW	*	3,333	33	33
*LZ1QZ	*	1,875	26	25
*LZ3YY	28	282,300	423	300
*LZ4UU	*	232,900	386	274
*LZ2GS	*	81,430	188	170
*LZ2FQ	*	51,765	145	119
*LZ3RN	*	51,054	135	127
*LZ2FM	21	86,708	247	212

AUSTRIA

OE4A	A	7,216,733	3030	989
			(Op: OE1EMS)	
OE8SKQ	A	6,480,642	2872	938
OE7AJT	*	703,818	625	366
OE9MON	28	6,214,149	2807	841
OE3WMW	7	14,746	78	73
*OE8WED	A	2,376	38	36

FINLAND

OH5LF	A	6,568,320	2860	933
OH3MMM	A	5,297,812	2593	884
			(Op: OH1NOA)	

OI5AX	**A**	**3,453,280**	**2083**	**764**	
					(Op: OH2JTE)
OH3UU	*	3,301,317	1885	769	
OH4KZM	*	1,594,527	1261	633	
OH5NE	*	1,041,698	1049	518	
OH1BV	*	206,550	302	270	
OH3JR	*	168,432	302	232	
OH4MCV	*	95,186	232	182	
OH3RF	*	86,688	224	172	
OH1F	**28**	**3,538,290**	**1870**	**735**	
					(Op: OH1MDR)
OH9MM	**28**	**3,170,396**	**1731**	**724**	
OH5BM	**21**	**5,314,725**	**2501**	**897**	
OH4MDY	**21**	**3,452,680**	**1957**	**760**	
OH7WP	**21**	**3,013,227**	**1847**	**749**	
OH9A	*	1,151,319	932	557	
					(Op: OH3WW)
OH8L	**14**	**3,362,712**	**2048**	**839**	
					(Op: OH8LQ)
OH7WW	*	60,720	227	176	
OH1N	**3.7**	**336**	**12**	**12**	
					(Op: OHØJJS)
OH3BU	**1.8**	**9,372**	**73**	**66**	
***OH8CW**	**A**	**1,375,704**	**1113**	**594**	
***OH2LYP**	**A**	**545,725**	**686**	**415**	
*OH2CV	*	216,734	365	274	
*OH6NJ	*	160,130	274	239	
*OH4RH	*	123,654	301	222	
*OH1TD	*	80,104	200	152	
*OH3KAV	*	74,080	181	160	
***OH1LEG**	**28**	**508,131**	**529**	**387**	
***OH4YT**	**28**	**73,319**	**184**	**157**	
*OH3HM	*	28,952	109	94	
*OH5HCK	*	18,360	91	85	
*OH5PA	*	4,160	41	40	

CZECH REPUBLIC

OK1EP	**"**	**2,477,370**	**1551**	**705**
OK2ABU	*	868,224	871	476
OK2RZ	**28**	**6,611,220**	**2858**	**891**
OK1FCJ	**28**	**1,098,900**	**886**	**495**
OL5TEN	*	333,270	427	322
				(Op: OK1JN)
OK1FPS	**21**	**570,710**	**644**	**434**
OK1DKA	*	145,180	290	238
OK1XC	*	112,968	254	216
OK1RI	**7**	**4,079,256**	**1642**	**696**
OK1IE	*	128,520	219	189
***OK6DX**	**A**	**1,216,600**	**1069**	**553**
				(Op: OK1DCF)
***OK1BA**	**A**	**739,200**	**768**	**440**
*OK2SGY	*	733,044	598	444
*OK1DDO	*	629,253	700	417
*OK1AOU	*	200,928	736	273
*OK2VP	*	199,563	367	273
*OK2KG	*	183,138	355	262
*OK1FMX	*	156,375	294	225
*OK2XA	*	64,800	177	150
*OK2BWC	*	16,652	101	92
*OK1MJA/P	*	6,670	61	58
***OK1QM**	**28**	**835,380**	**732**	**468**
***OK1ARI**	**28**	**580,944**	**605**	**399**
*OK1KDT	*	285,300	383	300
*OK2ZJ	*	177,276	292	237
*OK2QX	*	109,545	227	201
*OK1MZM	*	100,980	217	180
*OK2PBG	*	48,895	147	127
*OZ1AKN	*	24,386	110	89
*OK2BHE	*	7,600	54	50
***OK2HZ**	**21**	**339,150**	**453**	**350**
*OK1MFG	*	48,900	197	150
*OK2DU	*	17,286	103	86
***OK1SI**	**3.7**	**159,808**	**334**	**227**
*OK1ZMS	*	64,428	205	156
*OK1MWV	*	53,332	201	134
*OK2ZV	*	31,351	128	107
***OK2SNX**	**1.8**	**79,870**	**250**	**163**

SLOVAKIA

OM5DX	**A**	**6,262,099**	**2845**	**857**
OM3IAG	**A**	**1,920,133**	**1357**	**631**
OM3EA	**28**	**949,212**	**813**	**459**
***OM6T**	**A**	**2,561,132**	**1655**	**716**
				(Op: OM5AW)
***OM4DN**	**A**	**650,580**	**748**	**420**
*OM3YK	*	384,953	525	331
*OM7AG	*	140,676	309	228
*OM7VF	*	106,981	306	203
*OM6TX	*	80,181	224	177
*OM8MM	*	8,232	69	56
***OM4KK**	**28**	**278,442**	**386**	**279**
*OM6RU	*	22,446	102	87

BELGIUM

ON4KMB	**A**	**4,180**	**41**	**38**
OTØL	**28**	**1,905,624**	**1271**	**597**
***ON4APU**	**A**	**1,686,729**	**1217**	**647**
***ON5GQ**	**A**	**1,318,832**	**1060**	**593**
*OR5EU	*	382,680	527	360
				(Op: DF3TJ)
*ON4XG	*	372,222	553	339
*ON9CLV	*	153,455	307	235
*ON5CZ	*	38,920	160	140
*ON7SS	*	37,668	150	129
***ON7NQ**	**28**	**1,764,726**	**1134**	**591**
*ON4TO	*	175,112	310	212

DENMARK

5P1ER	**A**	**6,117,648**	**2970**	**932**
				(Op: TF3CW)
OZ5EV	*	470,912	497	416
OZ7HAM	**28**	**631,395**	**630**	**405**
				(Op: OZ1MAT)
OZ1ETA/P	**3.7**	**79,860**	**237**	**165**
OZ3SK	**1.8**	**180,708**	**396**	**222**
***OZ8NJ**	**A**	**450,211**	**608**	**373**
*OZ4NA	*	297,569	504	331
*OZ8AE	*	24,035	102	95
***OZ8KV**	**21**	**101,972**	**234**	**212**
***OZ7AEI/A**	**3.7**	**27,248**	**128**	**104**

THE NETHERLANDS

PAØKHS	**A**	**1,254,960**	**1128**	**560**
PAØIJM	**28**	**1,961,505**	**1374**	**585**
***PA4WM**	**A**	**1,111,671**	**920**	**513**
***PA2SWL**	**A**	**334,332**	**505**	**333**
*PAØKDM	*	250,250	391	275
*PAØJNH	*	203,144	304	268
*PA3GZC	*	156,104	346	247
*PA3ELD	*	52,328	150	124
***PA9KW**	**28**	**21,672**	**100**	**86**
***PA3GGW**	**14**	**27,940**	**144**	**127**
***PAØMIR**	**3.7**	**101,556**	**248**	**182**

SLOVENIA

S5ØK	**A**	**8,321,280**	**3439**	**985**
S57S	**A**	**7,594,400**	**3220**	**880**
S56R	**A**	**1,896,449**	**1368**	**547**
				(Op: S53R)
S55A	*	1,622,880	1320	588
S52LW	*	535,051	611	383
S53DX	*	176,897	389	259
S53T	**28**	**4,844,421**	**2355**	**807**
				(Op: S57DX)
S56M	**21**	**6,151,317**	**2721**	**941**
S5ØR	**21**	**1,300,032**	**1020**	**592**
S53M	**14**	**3,782,415**	**1996**	**815**
S57M	**1.8**	**282,382**	**464**	**271**
***S59AA**	**A**	**1,415,484**	**1089**	**574**
***S57LWG**	**A**	**519,153**	**551**	**393**
*S57NPR	*	401,115	525	363
***S57AW**	**28**	**2,579,733**	**1511**	**663**
*S59SLO	*	37,584	133	116
***S58N**	**21**	**2,255,825**	**1443**	**715**
***S57IIO**	**21**	**1,968,935**	**1287**	**695**
***S58AL**	**14**	**3,250,522**	**1809**	**781**
***S51CK**	**14**	**2,505,048**	**1635**	**744**
***S59GMA**	**7**	**422,037**	**516**	**319**
*S54A	*	209,088	331	242
***S53F**	**3.7**	**361,900**	**572**	**308**

SWEDEN

SK3W	**A**	**8,333,325**	**3277**	**975**
				(Op: SM3SGP)
SL3A	**A**	**4,557,000**	**2302**	**840**
				(Op: SM3WMV)
SJ9WL	**A**	**4,162,449**	**2222**	**857**
8S2F	*	3,519,708	2019	786
				(Op: SM2ODB)
8S4Z	*	2,008,655	1399	649
				(Op: SM4SET)
SM6WQB	*	1,455,664	1123	574
SM6FUD	*	1,215,296	1000	544
7S2A	*	574,218	702	414
SMØR	*	401,709	519	329
				(Op: SMØRUX)
SM3LIV	*	318,136	483	322
7S4A	*	247,976	380	278
				(Op: SM4ATJ)
SM3CBR	*	98,455	227	203
SM3AF	*	72,540	250	186
SM7DXQ	*	27,030	110	106
8S7M	*	13,650	91	78
				(Op: SM7DXQ)
SKØUX	**28**	**5,409,838**	**2530**	**787**
				(Op: SMØTQX)
8S7A	**28**	**3,343,632**	**1892**	**656**
				(Op: SM7CRW)
SM2CEW	**21**	**582,010**	**656**	**407**
SMØKV	*	5,635	51	49
7S5A	**14**	**1,464,440**	**1264**	**620**
				(Op: SM5CEU)
7S2E	**7**	**281,158**	**359**	**257**
				(Op: SM2DMU)
***7S5S**	**A**	**1,425,787**	**1162**	**571**
				(Op: SM5CSS)
***SM4AIO**	**A**	**1,059,322**	**1000**	**538**
*SM7BZV	*	677,980	776	436
*SM5NBE	*	462,560	668	392
*SM7BJW	*	455,175	550	357
*7SØZ	*	313,296	481	321
				(Op: SMØNZZ)
*SMØFM	*	27,550	111	95
*8SØW	*	7,203	55	49
				(Op: SMØNJO)
***SK4UW**	**28**	**253,536**	**387**	**278**
				(Op: SM4JHK)
***SM3D**	**28**	**191,694**	**359**	**258**
*SM5TSP	*	45,612	162	126
*7S6W	*	38,081	135	113
				(Op: SM6DER)

POLAND

SP6AZT	**A**	**3,020,111**	**1711**	**773**
SP2JMR	**A**	**1,439,973**	**1112**	**579**
SP6CZ	**A**	**1,362,500**	**946**	**625**
SP4OZ	*	48,764	2237	124
SQ4UCX	**28**	**87,205**	**227**	**163**
SP5BNB	**28**	**45,875**	**146**	**126**
SP9DGO/P	*	19,952	90	86
SP2DKI	*	3,312	36	36
SP7GIQ	**21**	**5,682,285**	**2561**	**859**
SP4DEU	**21**	**1,724,982**	**1203**	**613**
SP7VC	**1.8**	**225,018**	**431**	**243**
***SP9X**	**A**	**1,168,869**	**1000**	**533**
				(Op: SP9XWD)
***SNØLZD**	**A**	**1,048,950**	**933**	**525**
***SP7A**	**A**	**359,242**	**490**	**337**
*SP6SOX	*	326,508	414	364
*SP5JCS	*	319,770	459	323
*SP9HQC	*	274,596	419	294
*SQ8GBN	*	144,372	302	227
*SP3XR	*	130,536	246	196
*SQ7BCG	*	95,880	255	188
*SP9GFI	*	84,830	212	170
*SP6OPY	*	54,870	176	155
*SP9XUE	*	47,600	160	136
*SP9KJU	*	46,998	151	126
*SP1EOI	*	34,068	114	102
*SP9LAS	*	28,900	110	100
*3Z4ACO	*	11,400	65	60
*SP6IEQ	*	9,018	65	54
*SP8DYY	*	6,670	51	46
*SP7LHX	*	5,265	58	35
*SP1DID	*	2,550	36	34
*SP6BEN	*	2,464	30	28
*SP9IKN	*	2,416	44	40
*SP6OPE	*	504	14	14
***SP5IVC**	**28**	**491,136**	**534**	**384**
***SQ9HYM**	**28**	**428,364**	**517**	**326**
*SN6O	*	326,270	420	295
				(Op: SP23022)
*SP5LCC	*	275,280	342	296
*SP9ELM	*	8,607	59	57
***SP4TKR**	**21**	**1,104,192**	**940**	**568**
*SP5BB	*	137,540	276	230
*SP6TRH	*	1,040	21	20
***SP9EWO**	**14**	**318,054**	**481**	**366**
*SP4AAZ	*	28,556	130	121
*SO7VH	*	5,478	69	66

GREECE

***SV1APA**	**A**	**504,639**	**782**	**423**
*SV2EVA	*	90,497	231	209
***SW2A**	**28**	**1,095,073**	**1016**	**511**
				(Op: SV2AEL)
*SV1EDZ	28	902,060	1209	460
***SV1DPI**	**3.7**	**45,276**	**159**	**132**

BOSNIA & HERZOGOVINA

T99W	**28**	**5,610,068**	**2561**	**844**
***T94LW**	**A**	**769,366**	**799**	**466**
*T94DO	*	669,596	739	458
*T97M	*	36,652	138	119
***T95DXT**	**21**	**360,396**	**423**	**284**
***T91AAW**	**7**	**245,116**	**405**	**263**
				(Op: T98R)
***T95MOJ**	**3.7**	**80,842**	**228**	**166**
*T95MEQ	*	62,250	195	150

TURKEY (EUROPEAN)

TA1FA	**A**	**1,326,898**	**1117**	**698**

ICELAND

TF8GX	**A**	**2,564,290**	**2000**	**745**

RUSSIA

RW4AA	**A**	**8,052,477**	**3568**	**1047**
RU3QW	**A**	**2,917,845**	**1986**	**785**
UF3CWR	**A**	**2,021,334**	**1499**	**714**
UA4LU	*	1,815,054	1364	687
RA6LBS	*	1,805,454	1394	623
RK3DH	*	1,608,152	1301	611
UA1QV	*	1,312,155	1200	585
RV1CC	*	531,454	561	374
RA1ABU	*	349,114	539	346
RU1AB	*	306,078	370	278
RA1AIM	*	220,272	445	312
UA4LY	*	220,131	373	279
RA1TC	*	202,046	322	247
RK6BZ	*	156,816	383	242
RZ1AZ	*	151,320	278	195
UA3BZ	*	128,077	266	211
RA3XO	*	108,058	241	194
RX3RZ	*	66,063	221	183
UA3DPX	**28**	**2,662,080**	**1600**	**705**
RN4LP	**28**	**2,512,696**	**1774**	**709**
RV4CT	**28**	**1,299,584**	**1200**	**572**
RK3XWD	*	954,450	845	505
RA4CC	*	560,180	702	370
RA3AA	*	388,788	555	358
RA4AG	*	34,866	165	117
RU4HP	*	19,872	134	108
RM4W	**21**	**4,963,626**	**2387**	**918**
				(Op: RW4WR)
RN3RQ	**21**	**1,308,966**	**1154**	**626**
UA6CW	*	296,745	478	271
RX3AP	*	14,432	95	82
RW4PL	**3.7**	**320,606**	**449**	**286**
RA3VV	*	19,992	103	98
***UA3ABJ**	**A**	**1,508,950**	**1157**	**586**
***RZ6LG**	**A**	**1,344,432**	**1042**	**592**
***UA4FER**	**A**	**1,231,772**	**1132**	**586**
*UA1ANA	*	1,006,870	1008	535
*RA3LBW	*	832,276	803	466
*RA1AKE	*	572,440	746	440
*UA3LHL	*	567,240	580	489
*RW3QO	*	315,400	441	332
*RU3DVR	*	280,640	456	320
*RX1CQ/1	*	258,804	509	316
*RA3DNC	*	256,312	463	322
*RW4LC	*	246,521	459	307
*RN1TN	*	194,704	401	283
*UA3AGS	*	194,580	308	235
*RU4WE	*	134,784	341	234
*UA4RF	*	104,705	267	215
*RU3AQX	*	51,653	167	157
*UA1WAL	*	36,765	148	129
*RV3YR	*	30,464	136	119
*UA3UND	*	20,832	99	93
*UA4ACP	*	14,880	87	80
*UA4HAK	*	13,776	101	82
*RA3VR	*	210	9	7
***UA4LCQ**	**28**	**3,904,312**	**2204**	**823**
***RZ3AA**	**28**	**1,501,224**	**1129**	**568**
*RA1AW	*	470,242	534	382
*RV3ACA	*	311,892	467	316
*RU3WR	*	116,820	243	198
*UA4LBK	*	98,176	243	208
*UA3XBB	*	70,679	191	161
*RZ4AYT	*	69,840	302	180
*UA4LDP	*	36,579	162	137
*UA3XAC	*	31,892	129	119
*RW3VZ	*	119	7	7
***RU4PL**	**21**	**4,223,076**	**2152**	**858**
*RV6AVE	*	249,271	477	241
***UA3BL**	**14**	**591,690**	**774**	**489**
*UA3IKO	*	460,950	664	439
*RW3XZ	*	398,310	612	426
***RW3DU**	**3.7**	**174,000**	**338**	**232**

KALININGRAD

RW2F	**7**	**3,439,494**	**1423**	**678**
				(Op: UA2FB)
***RN2FA**	**A**	**2,475**	**33**	**33**

UKRAINE

UV7D	**A**	**4,328,150**	**2336**	**809**
				(Op: UT7DX)
UY4I	**A**	**2,899,500**	**2044**	**750**
				(Op: US3IZ)
UV5U	**A**	**1,476,747**	**1269**	**603**
				(Op: UX1UA)
UT4EK	*	1,055,376	1032	504
UT6EE	*	579,012	742	427
UR6IJ	*	542,035	703	403
UT5HP	*	125,749	261	221
UT7MD	*	51,680	190	170
US9QA	*	46,041	194	149
UU2JZ	**28**	**3,534,264**	**1970**	**771**
EM7Q	**28**	**3,349,821**	**2033**	**719**
				(Op: UY5ZZ)
UW5I	**28**	**2,568,693**	**1735**	**687**
UT2QT	*	1,215,648	1020	536
UZ5U	*	1,208,832	977	512
EM8I	*	1,119,404	1136	494
UY2UA	*	917,631	839	429
UR5WIF	*	186,186	317	231
UZ7U	**21**	**3,266,060**	**1879**	**820**
				(Op: UT3UA)
UT9F	**21**	**2,903,304**	**1804**	**822**
				(Op: UT9FJ)
UR6MX	**21**	**1,713,765**	**1400**	**645**
EN7M	*	1,408,608	1204	603
				(Op: UX2MM)
UT5RQ	*	241,780	436	308
UR3IOB	*	85,476	268	204
UX3MR	**14**	**874,293**	**866**	**527**
UX6F	*	525,768	802	456
				(Op: US-F-Ø27)
UW5Y	**7**	**1,061,214**	**814**	**462**
				(Op: US2YW)
UX7MM	*	336,674	462	299
UR3QCW	**3.7**	**356,360**	**521**	**302**
UR6QA	**1.8**	**69,762**	**205**	**154**
***UW7I**	**A**	**1,297,912**	**1160**	**602**
				(Op: UX9IO)
***UX5UO**	**A**	**336,971**	**444**	**317**
*UR7EM	*	299,421	527	323
*UY5QZ	*	228,726	390	291
*UT5UML	*	146,556	303	236
*UT4EO	*	133,056	300	224
*UX1IL	*	116,289	300	219
*UT8IT	*	112,700	301	230
*UT1UA	*	106,554	226	177
*EO1I	*	15,708	81	77
				(Op: UT1IA)
***UYØUY**	**28**	**344,960**	**462**	**320**
*UT7QL	*	117,700	257	214
*UX3M	*	113,220	263	204
				(Op: UR3MP)
***UU7JX**	**21**	**1,061,024**	**1054**	**568**
*UY5TE	*	205,227	401	297
***UR8QR**	**14**	**284,425**	**503**	**367**
*UT4MW	*	42,075	163	153
***EM6M**	**1.8**	**48,800**	**166**	**122**
				(Op: UT5MB)

LATVIA

YL2KO	**A**	**4,030,887**	**2161**	**833**
YL2IP	*	12,474	70	63
YL2SM	**28**	**2,461,536**	**1518**	**616**
YL2GD	**7**	**401,320**	**480**	**316**
***YL2GN**	**A**	**1,355,255**	**1229**	**601**
*YL2SW	*	656,616	731	436
*YL2LW	*	23,712	136	114
***YL2NS**	**28**	**292,698**	**400**	**303**

ROMANIA

YO7ARY	**28**	**326,673**	**509**	**327**
YO8BGD	**3.7**	**118,800**	**281**	**198**
***YO2KAB**	**A**	**1,993,575**	**1004**	**475**
				(Op: YO2LIF)
***YO4CIS**	**A**	**544,862**	**632**	**398**
*YO3APJ	*	532,656	553	411
*YO5PBF	*	471,540	601	348
*YO3FWC	*	286,120	463	311
*YO8COK	*	83,134	234	211
*YO4ZZ	*	76,120	245	173
*YO8MI	*	48,506	182	158
***YO6BHN**	**28**	**210,880**	**312**	**245**
***YO3NL**	**28**	**75,330**	**200**	**162**
*YO2DFA	*	51,200	154	128
*YO8DHD	*	45,568	160	128
*YO8BGE	*	13,199	85	67
*YO7KQE	*	12,851	95	71
***YO8DDP**	**21**	**498,370**	**630**	**430**
***YO7KJL**	**14**	**31,624**	**135**	**118**
***YO9AHX**	**"**	**3,150**	**88**	**30**
***YO6BZL**	**3.7**	**122,007**	**292**	**201**
*YO2CJX	*	30,800	140	110

YUGOSLAVIA

YT1AD	**A**	**8,558,550**	**3344**	**990**
				(Op: Z32ZM)
4N1K	**28**	**4,652,039**	**2303**	**749**
				(Op: YU1WS)
YT7W	**28**	**1,998,010**	**1302**	**595**
YU1KX	**21**	**3,945,131**	**2023**	**841**
YU7CF	**21**	**1,566,232**	**1160**	**628**
YU1RE	*	401,767	511	383
YT1BB	**14**	**5,813,342**	**2684**	**989**
YTØA	**3.7**	**1,527,608**	**1036**	**514**
				(Op: YU1FW)
4N1A	**3.7**	**856,975**	**834**	**415**
				(Op: YT1DX)
***YU1EA**	**A**	**1,221,024**	**994**	**553**
***YU7WJ**	**A**	**484,008**	**600**	**402**
*YU7AM	*	114,246	250	198
*YU7AZ	*	87,792	10	177
*YZ1SG	*	4,366	43	37
***4N1SM**	**28**	**800,555**	**741**	**445**
*YU7SF	*	135,681	253	212
*YT1CS	*	102,438	242	189
*YU7KM	*	42,875	138	125
***YU7KWX**	**21**	**1,536,358**	**1179**	**619**
*4N1N	*	575,706	717	458
				(Op: 4N1JA)
***YU1HFG**	**14**	**1,164,312**	**1136**	**618**
***YZ1V**	**7**	**274,344**	**431**	**276**
***YU1BL**	**3.7**	**40,870**	**150**	**122**
***YU1UA**	**1.8**	**30,623**	**135**	**113**
*YU1AST	*	8,280	66	60
				(Op: YT1KA)

MACEDONIA

Z37FCA	**A**	**128**	**8**	**8**
Z35M	**7**	**1,040**	**20**	**20**
***Z32AF**	**A**	**565,536**	**701**	**411**

OCEANIA

EAST TIMOR

***4W6GH**	**A**	**1,666,442**	**1476**	**391**

THE PHILIPPINES

DU1DX	**A**	**282,828**	**385**	**259**
DU1SAN	**A**	**274,067**	**414**	**223**
DU1ODD	**28**	**933,394**	**765**	**418**
***DU7MHA**	**A**	**1,022,514**	**876**	**386**
***DU3SV**	**A**	**463,042**	**641**	**254**
***DU1IHU**	**21**	**488,931**	**552**	**237**

NEW CALEDONIA

***FK8VHN**	**A**	**1,145,376**	**1076**	**369**

SAIPAN

***KHØ/JH8KYU**	**A**	**5,453,832**	**2682**	**678**
*KHØCE	*	327,132	481	234

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GUAM

*AH2DN	21	1,153,500	1058	375

HAWAII

NH7A	A	10,602,210	3528	942
KH6ND	28	11,142,754	3854	982
AH7DX	21	7,645,990	2899	890
			(Op: KH6TO)	
KH6CQH	21	2,859,456	1559	636
AH6OZ	3.7	392,175	352	189
AH7R	1.8	5,292	34	28
*WH6DBI	28	13,936	72	67
*KH6GMP	21	112,347	221	171

AMERICAN SAMOA

AH8A	28	7,319,856	2840	876

PAPUA NEW GUINEA

P29NB	A	2,291,289	1430	539

CHESTERFIELD IS.

TXØDX	28	12,049,422	4786	847
			(Op: OH1RY)	

MARSHALL IS.

V73UX	A	1,756,664	1075	494

AUSTRALIA

VK5GN	A	7,799,293	2898	907
VK3TZ	A	4,554,869	2038	757
VK4UC	A	4,257,870	1890	710
VK8HZ	A	1,028,146	822	434
VK8AV	*	147,620	237	220
VK1MOJ	28	143,788	251	206
*VK2CA	A	1,060,409	787	469

PITCAIRN IS.

VP6BR	A	8,085,063	3053	877
			(Op: OH2BR)	

HONG KONG

VR2MY	A	1,748,424	1500	554
VR2BG	28	67,482	164	163

INDONESIA

*YCØQO	A	15,288	82	80
*YB3ZBZ	21	706,878	713	346
			(Op: YD3LVR)	
*YCØONE	21	680,346	612	387
*YC8TXW	*	600,678	685	302
*YF1DKT	*	157,796	270	206
*YC8UFF	*	15,040	95	55

NEW ZEALAND

ZL1ANJ	A	2,780,544	1448	624
*ZS6IR/ZL/M	A	18,225	84	81

SOUTH AMERICA

CHILE

CE8SFG	A	2,228,297	1323	607
CE6DFY	28	708,072	653	362
*CE8EIO	A	623,516	593	388
*CE8NKR	*	66,700	181	145
*XQ2PPA	*	9,676	61	59
*CX8BAE	28	549,270	550	359

URUGUAY

CW8C	28	6,893,084	2639	902
CW6V	28	6,383,080	2464	890
			(Op: CX6VM)	

ECUADOR

HC1HC	28	7,120,836	2730	887
*HC1JQ	21	132,076	254	178

GALAPAGOS IS.

HD8Z	A	12,534,148	3978	1034
			(Op: HC1OT)	

COLOMBIA

HK6PSG	28	2,036,604	1235	564
*HK3LT	A	236,070	346	215

ARGENTINA

LU1BR	A	2,045,972	1167	617
L2F	28	8,861,904	3205	948
			(Op: LU9FDG)	
LT1F	28	8,549,002	3091	946
			(Op: LU1FKR)	
LT1A	*	1,440,968	922	562
			(Op: LU3CT)	
LU2EC	*	1,076,300	803	470
LW8EXF	*	605,642	574	379
LU/OHØWW	*	4,070	38	37
L99D	21	5,892,976	2312	872
			(Op: LU7DW)	
LU3FZW	21	3,788,028	1701	757
LU7H	*	336,336	417	286
			(Op: LU2HAO)	
*LO7H	A	3,191,209	1585	709
			(Op: LU7HN)	
*AYØN	A	2,979,264	1480	708
			(Op: LU2NI)	
*LU2HF	A	1,052,091	889	417
*LU5FF	*	983,216	763	464
*LU4FCZ	*	452,848	490	332
*LU3HKA	*	430,650	478	319
*L44D	*	242,004	330	268
*LU9JTC	*	21,748	151	128
*L21H	28	4,018,443	1881	741
*LP1F	28	3,551,646	1707	721
*LU3HIP	28	3,358,016	1577	739
*LU2UE	*	1,138,810	862	470
*LW7EIC	*	1,013,376	788	448
*LU9YBP	*	952,038	735	466
*LW1EGD	*	841,978	749	394
*LU1VEW	*	800,827	752	379
*LU5EVK	*	452,732	505	322
*LW9DAH	*	168,300	271	220
*LU5JKG	*	107,136	224	192
*LP7H	21	1,674,414	1007	582
			(Op: LU9HS)	
*AY5E	21	741,576	611	424
			(Op: LU5DV)	
*LU3ES	*	109,983	222	183

PERU

OA4EI	A	546,884	566	338

ARUBA

P4ØV	A	16,638,841	4822	1091
P43E	A	9,968,154	3326	966

NETHERLANDS ANTILLES

PJ9/ON4CFD	28	6,441,120	2640	840

BRAZIL

PQ7BZ	A	4,909,765	1973	755
			(Op: PT7BZ)	
PY1KN	A	625,494	615	366
PY2TVQ	*	49,680	160	138
PY3CGP	28	76,788	188	158
PY2DBU	*	43,188	132	118
PY1SX	*	30,070	106	97
PY2NY	7	254,794	247	191
*ZX2B	A	5,543,838	2240	846
			(Op: PY2MNL)	
*PY2YU	A	3,818,388	1704	786
*PP2RON	A	606,616	598	382
*PT2AW	*	421,794	490	321
*ZY7Y	*	213,428	325	233
			(Op: PY7YL)	
*PY7IQ	*	119,712	230	174
*PY1WAG	*	58,786	160	133
*PY2DJ	*	48,375	163	129
*PV8IG	*	27,004	96	86
*PY2AER	*	24,119	99	89
*PY1AFS	*	10,318	76	67
*PY7BEL	*	4,641	65	51
*PY5AG	*	1,188	22	22
*ZY4K	28	3,359,242	1642	709
			(Op: PY4BK)	
*PY2NW	28	1,872,192	1098	597
*PY5HSD	28	1,543,985	1002	545
*PY2KDX	*	830,250	693	410
*PU2LQD	*	540,792	535	348
*PY2KPY	*	305,081	401	287
*PV5M	*	256,620	382	260
*PP8EB	*	156,040	294	188
*PY5DC	*	99,925	220	175
*PY2RDA	*	90,514	216	167
*PP5CN	*	78,387	193	159
*PY2NDX	*	53,928	155	126
*PY2LED	*	50,508	152	138
*PY2DDK	*	26,037	125	99
*PY2RCI	*	16,351	109	83
*PY4XYZ	*	15,120	90	84
*PU7ENW	*	2,310	38	35
*PY3FBI	21	251,600	347	272
*PY2WVT	*	7,614	57	54
*ZZ7Z	14	47,725	151	115
			(Op: PR7AR)	
*PY2EDY	7	806	13	13

VENEZUELA

YW1A	21	3,126,675	1509	705
			(Op: YV1AVO)	
*YV7QP	A	74,385	167	145
*YV5NWG	*	918	20	18
*YY5OIA	28	1,298,860	954	505

PARAGUAY

ZP5SAT	A	1,736,411	1065	571

TRIBANDER/SINGLE ELEMENT

UNITED STATES

K6LL/7	A	7,226,691	3102	929
KZ5D	A	5,736,192	2630	896
N4PN	A	5,611,998	2435	861
W1CU	A	5,171,166	2210	858
N1EU	*	4,586,296	1908	844
ND8DX	A	4,477,815	2045	809
KE9NA	A	4,155,200	2042	784
WA7EQW	*	4,152,720	2127	780
NT1N	*	3,067,792	1578	728
K2PLF	A	2,911,458	1546	682
K7ZZ	*	2,802,637	1692	697
K2UOP	*	2,551,950	1437	642
W6TK	*	2,273,645	1415	617
NW6S	*	2,245,628	1301	634
KR4QI	*	2,201,888	1334	632
KE5OG	*	1,946,004	1431	631
W7WW	*	1,715,472	1249	594
KC3TL	*	1,582,796	1066	538
WR4F	*	1,073,709	869	483
N3HXQ	*	995,280	832	464
K6III	*	896,368	808	463
KE6ZSN	*	857,394	755	414
NØUU	*	841,940	687	445
W7QN	*	606,023	684	407
W4YDY	*	447,888	500	336
NC4MI	*	349,554	460	298
K6ACZ	*	259,840	354	256
KE4OAR	*	229,080	341	249
N6VH	*	221,188	358	242
WØPPF	*	193,155	326	237
AJ6V	*	190,734	344	249
KF9YR	*	109,794	243	174
W3OU	*	63,627	159	127
KØCOP/4	*	51,448	150	118
KØCAT	28	860,292	745	414
			(Op: K9WIE)	
N9HCA	14	967,500	841	516
NI2P	14	8,208	57	54
*WD5K	A	3,323,214	1734	779
*KG2AU	A	1,972,000	1223	580
*WS7V	A	1,704,678	1191	606
*KO4MM	A	1,448,966	993	514
*NR6R	A	1,426,918	1114	562
			(Op: K6AM)	
*KW4T	A	1,359,720	989	540
*AJ3M	A	802,200	726	420
*KA2D	*	608,457	588	381
*N8DXR	A	561,408	620	384
*AK4ST	*	411,336	463	348
*K1DCB	A	409,118	511	337
*WK5K	*	384,370	513	323
*K9SH	A	352,024	441	316
*N2CK	*	319,158	424	298
*WA2CPP	*	317,322	420	289
*N3UM	*	304,777	391	269
*W6SA	*	268,400	378	275
*K9MMS	*	257,655	375	267
*K4IU	*	178,250	309	230
*AF8C	*	176,847	305	233
*WA1ZYX	*	176,579	291	221
*KY5S	*	119,798	240	199
*AD6Z	*	29,972	133	118
*WG1Z	28	1,134,159	833	507
*NG9L	28	131,670	231	209
*NØIBT	28	128,700	240	198
*KD6PQF	28	38,586	139	118
*WA1FCN	21	480,000	476	384
*W6YJ	21	326,625	412	335
*WR6WR	14	68,747	184	161

DX

3V8BB	A	15,266,880	4327	1080
			(Op: YT1AD)	
JY9NX	A	11,000,096	4056	907
			(Op: JM1CAX)	
P43E	A	9,968,154	3326	966
VA3UZ	A	9,026,416	3126	971
S5ØK	A	8,321,280	3439	985
VP6BR	A	8,085,063	3053	877
			(Op: OH2BR)	
OE4A	A	7,216,733	3030	989
			(Op: OE1EMS)	
5P1ER	A	6,117,648	2970	932
			(Op: TF3CW)	
IK4MTF	A	4,671,975	2346	809
VK3TZ	A	4,554,869	2038	757
4U1VIC	A	4,313,568	2362	784
SJ9WL	A	4,162,449	2222	857
VO1WET	A	4,020,792	2163	636
VE5CPU	A	3,381,848	1744	722
JAØQWO	A	3,074,922	1654	666
ZL1ANJ	A	2,780,544	1448	624
AN6AEQ	A	2,532,816	1630	738
OK1EP	A	2,477,370	1551	705
DJ5BV	A	2,235,120	1440	695
CE8SFG	A	2,228,297	1323	607
IK4AUY	*	2,206,464	1439	676
S56R	A	1,896,449	1368	547
			(Op: S53R)	
DF6QV	*	1,843,170	1312	655
RA6LBS	A	1,805,454	1394	623
EA2CLU	A	1,785,187	1197	607
S55A	*	1,622,880	1320	588
OH4KZM	A	1,594,527	1261	633
UV5U	A	1,476,747	1269	603
			(Op: UX1UA)	
LY2OX	A	1,218,016	1029	544
EU5A	A	1,170,115	1007	545
			(Op: EU4AB)	
VY2LI	A	1,050,090	775	435
OK2ABU	*	868,224	871	476
EX8MDA	A	641,600	607	400
OA4EI	A	546,884	566	338
JG3VEI	*	408,555	472	315
RZ9AWO	A	358,470	444	315
			(Op: UA9AM)	
II4A	*	223,860	430	273
			(Op: IK4ADE)	
JH1CTV	*	153,266	290	197
RZ1AZ	*	151,320	278	195
7J1ABD	*	140,844	245	194
JA3ARM	*	58,320	158	135
DJ1MM	*	35,462	144	119
JA2QVP	*	7,344	50	48
G3UYF	*	6,525	49	45
CW6V	28	6,383,080	2464	890
			(Op: CX6VM)	
AM3ATM	28	4,250,834	2176	791
HAØDU	28	4,134,026	2006	799
DK2OY	28	1,506,978	1100	531
LW8EXF	28	605,642	574	379
JR7RJZ	28	385,088	412	352
L99D	21	5,892,976	2312	872
			(Op: LU7DW)	
OH3BU	1.8	9,372	73	66
*ZX2B	A	5,543,838	2240	846
			(Op: PY2MNL)	
*KHØ/JH8KYU	A	5,453,832	2682	678
*UP5P	A	5,406,314	2270	853
			(Op: UN5PR)	
*PY2YU	*	3,818,388	1704	786
*C6AJZ	A	3,404,146	1942	698
			(Op: WI9WI)	
*3B8MM	A	3,245,999	1679	647
			(Op: DL6UAA)	
*AYØN	A	2,979,264	1480	708
			(Op: LU2NI)	
*VO1BC	A	2,111,587	1338	557
*VE3STT	A	2,022,884	1185	566
*AN3GEG	A	1,566,432	1303	588
*UA3ABJ	A	1,508,950	1157	586
*ON5GQ	A	1,318,832	1060	593
*JA9SCB/1	A	1,305,808	910	524
*AN1DAX	*	1,253,160	1172	590
*UAØSJ	A	1,158,346	870	527
*AN1AJV	*	1,155,336	1185	552
*VO1GO	*	1,147,467	886	491
*FK8VHN	A	1,145,376	1076	369
*PA4WM	A	1,111,671	920	513
*JI3BFC	*	1,110,200	828	488
*7K4GUR	*	1,107,400	785	490
*GØKRL	A	1,105,864	1012	548
*SM4AIO	A	1,059,322	1000	538
*UA1ANA	*	1,006,870	1008	535
*LU5FF	*	983,216	763	464
*AM5EOR	*	901,476	904	491
*VE1OP	A	891,870	752	411
*RA3LBW	*	832,276	803	466
*WP4LNY	A	810,475	777	425
*DL1MGB	A	763,504	815	476
*IQØA	A	733,326	808	451
			(Op: IKØXBX)	
*JN3SAC	*	721,000	644	412
*DH8AF	*	654,048	650	432
*9M2TO	A	596,772	836	396
			(Op: JAØDMV)	
*JG1OWV	*	548,628	545	349
*SM5NBE	*	462,560	668	392
*LU3HKA	*	430,650	478	319
*PT2AW	*	421,794	490	321
*EA9AR	A	420,525	430	315
*UA9ORQ	A	409,820	464	310
*4XØF	A	403,845	465	327
			(Op: 4Z5FL)	
*AN7BJV	*	377,571	605	381
*AM1AUM	*	364,356	555	349
*ZS9P	A	333,828	408	281
			(Op: ZS6PHD)	
*JR1MRG	*	307,800	423	270
*JE1REU	*	285,782	400	274
*JJ3TBB	*	278,517	400	263
*RA3DNC	*	256,312	463	322
*AN7OO	*	248,320	535	320
*EA5QB	*	222,750	392	275
*IT9OJW	A	221,265	421	297
*LA3BO	A	196,840	454	280
*JO3JYE	*	194,250	304	222
*AN6LP	A	185,496	380	262
*EA1AE	*	167,919	335	251
*UN9FD	*	162,216	285	216
*OH6NJ	A	160,130	274	239
*PY7IQ	*	119,712	230	174
*JGØOXL	*	115,840	226	181
*CT1ELF	A	112,944	281	208
*JH6FTJ	*	101,996	223	172
*EA3DVJ	*	86,592	231	192
*SP9GFI	A	84,830	212	170
*EA3DTQ	*	67,093	208	169
*JE8KXX	*	64,656	173	144
*JH5OXF	*	52,877	144	121
*PA3ELD	*	52,328	150	124
*PY2DJ	*	48,375	163	129
*EA1BAW	*	47,704	154	134
*JHØNEC	*	43,407	145	117
*EA1RH	*	37,940	169	140
*7L4PWR	*	36,740	135	110
*SP9LAS	*	28,900	110	100
*EA3NA	*	27,839	117	97
*JAØGEY	*	24,208	94	89
*PY2AER	*	24,119	99	89
*JG3NKP/1	*	22,176	92	84
*EA5CRU	*	21,114	112	102
*EA7TG	*	20,493	114	99
*ZS6IR/ZL/M	A	18,225	84	81
*EO1I	*	15,708	81	77
			(Op: UT1IA)	
*LZ4BU	A	10,890	70	66
*EA3AGB	*	8,008	56	52
*EA6JN	*	6,188	75	52
*IZ4AKS	*	5,356	53	52
*JA9EJG	*	4,284	40	36
*DL1SBF	*	1,960	30	28
*7J7ACZ	28	662,890	554	439
*JA4BAA	*	140,456	260	194
*OK2QX	28	109,545	227	201
*AM5DIT	28	20,094	107	102
*WH6DBI	28	13,936	72	67
*VE3MQW	21	516,800	505	380
*AN5TN	21	2,068	108	101
*J68TD	14	1,368,954	1021	502
			(Op: KD4YHY)	
*EA2CHL	14	13,100	109	100
*J68DD	7	17,380	55	55
			(Op: N6JRL)	
*PAØMIR	3.7	101,556	248	182
*JE1SPY	3.7	1,975	25	25
*JE4MHL	*	6	1	1

BAND RESTRICTED

LW8EXF	28	605,642	574	379
*JA5EO	A	1,162,130	879	463
*EF3AGC	A	1,139,401	1134	547
*JAØBMS/1	*	742,560	674	416
*UA3LHL	A	567,240	580	489
*S57LWG	A	519,153	551	393
*S57NPR	*	401,115	525	363
*AM5AJX	*	249,162	443	317
*EC4AIH	*	85,215	260	195
*JL3RDC	*	72,141	201	139
*VE4HAZ	A	28,119	100	91
*EC7AMD	*	8,004	82	69
*OK1MJA/P	A	6,670	61	58
*EC1ALY	*	3,478	38	37
*JL4OND	*	572	26	22
*YY5OIA	28	1,298,860	954	505
*LW1EGD	28	841,978	749	394
*N4SEA/T	28	801,614	679	439
*NØOFR	28	475,750	490	346
*VA7DP	28	282,960	399	262
*KB9JIF/T	28	257,508	357	276
*K6KAY/T	28	254,898	513	289
*KC4UCK/T	*	180,509	299	241
*KA1RLI	28	134,618	244	211
*KF4KSN/T	*	92,004	280	123
*WA5VKS/T	28	48,240	149	134
*W5CTV	*	43,173	136	123
*KE4GDQ/7	28	28,119	113	103
*7K2PBB	28	560	17	16
*EC4AGQ	21	70,670	240	191
*EF3PL	*	12,710	99	82
			(Op: EC3CMT)	
*JA7ADV	21	9,700	62	60

ROOKIE

CT9KN	A	5,315,912	2285	764
SL3A	A	4,557,000	2302	840
			(Op: SM3WMV)	
TF8GX	A	2,564,290	2000	745
KT1O	A	2,186,484	1240	618
V73UX	A	1,756,664	1075	494
SM6WQB	*	1,455,664	1123	574
F5UTN	A	707,544	603	372
DH1TST	A	495,110	614	385
RA1ABU	A	349,114	539	346
F5AOV	28	600,780	562	465
UA9OUB	28	162,603	282	203
*KX1X	A	1,298,345	1004	485
*UA9JLZ	A	1,196,415	915	495
*VK2CA	A	1,060,409	787	469
*IZ7CDB	A	675,510	699	445
*RA1AKE	A	572,440	746	440
*KG4BIG	A	499,008	545	339
*RU3DVR	*	280,640	456	320
*KC8HWV	A	239,400	340	266
*OH2CV	A	216,734	365	274
*KI8IZ	*	158,050	283	218
*N3ZYU	A	135,800	256	200
*W7AVA	A	123,410	268	215
*AN4EMC	A	106,855	264	215
*IZ2DAY	*	57,768	236	166
*EA2BVN	*	5,002	66	61
*UA9JMB	28	1,096,488	872	471
*PY2KDX	28	830,250	693	410
*UA9JPK	*	471,099	498	373
*F8CNR	28	253,328	366	284
*SM3D	28	191,694	359	258
*AC5SU	28	157,542	255	217
*KC8MNO	28	137,292	240	204
*YO7KQE	28	12,851	95	71

*SP9ELM	28	8,607	59	57
*EC1CGI	28	1,320	22	22
*4N1N	21	575,706	717	458
			(Op: 4N1JA)	
*KD7EJC	14	136	14	8

ASSISTED

UNITED STATES

W8EX	A	6,521,204	2599	932
			(Op: N8BJQ)	
N4WW	A	5,418,491	2281	871
K3WW	A	5,195,134	2192	866
WN9O	A	3,000,672	1526	736
NO2R	A	2,919,036	1505	697
N1NQD	A	2,023,584	1112	642
N5ER	A	1,510,710	981	555
N2WKS	*	1,024,254	747	462
KF3P	A	1,015,266	808	483
KB9MDL	*	1,004,000	770	502
KD2KS	*	773,388	673	434
K5MA	*	382,032	449	336
K8EI	*	344,277	412	311
K1TH	*	287,375	377	275
K2QMF	*	182,800	283	200
AAØA	A	77,345	203	155
K3IXD	*	71,686	181	146
W3UL	*	60,198	151	127
NF6R	A	49,206	147	118
AA2MU	*	37,771	123	107
K2XR	28	2,339,964	1259	684
			(Op: VE3XAP)	
KO4MR	28	1,763,850	1108	550
W2WB	*	584,568	516	414
KD4RH	7	71,043	137	119
AA1BU	1.8	51,408	239	136
W2MF	1.8	51,375	241	137
*K9PG	A	481,980	438	435
*N7UJJ	A	355,740	445	330
*KD2P	A	53,600	155	134

DX

TM2V	A	8,927,864	3444	1012
			(Op: F6GLH)	
JH4UYB	A	8,235,790	3205	895
UT5UGR	A	4,509,006	2452	831
SP9QMP	A	3,213,768	1889	718
AN5BM	A	2,751,435	1858	801
S5ØL	A	2,386,724	1525	607
			(Op: S53EA)	
OH9W	A	2,215,774	1485	667
			(Op: OH6EI)	
EA7DHP	A	2,036,480	1555	640
I2SVA	A	2,035,194	1282	658
DH1SGS	A	1,573,692	1167	597
OE5OHO	A	1,569,069	1153	557
VE9FX	A	1,062,068	801	457
JA8JCR	*	960,263	747	461
OE1WEU	A	760,743	712	467
JH4NMT	*	721,349	625	397
JQ1NGT	*	373,436	493	284
DL9GMN	*	134,673	293	231
IK2VJF	*	107,910	225	198
9A4KA	A	94,301	225	181
OE1TKW	*	25,938	105	99
OH2LU	*	24,000	108	100
4X2T	28	7,115,488	2851	916
			(Op: 4X6TT)	
IO2L	28	4,511,880	2204	830
			(Op: IK2QEI)	
JR5JAQ	28	4,018,682	1892	739
S5ØA	28	2,168,943	1407	577
OE3I	28	1,649,459	1100	581
			(Op: OE1JNB)	
S58DX	*	1,571,009	1124	569
UT7L	28	1,451,919	1100	581
			(Op: UR4QKD/A)	
IR8B	*	558,090	655	390
			(Op: IC8JAH)	
OM8A	21	4,813,784	2258	881
			(Op: OM3RM)	
OH6NIO	21	2,618,982	1684	747
IT9ZMX	21	933,336	922	522
IU9S	14	3,491,972	2139	836
			(Op: IT9BLB)	
IK5WGK	14	32,428	242	134
YU1UO	3.7	329,412	506	291
*VA3DX	A	5,935,776	2275	876
*YU1NR	A	2,230,266	1498	674
*ON4CAS	A	1,015,290	907	522
*VE3ZZ	*	968,765	809	445
*DL8NFU	A	603,460	670	422
*HAØHW	A	591,456	633	404
*7L4IOU	A	456,797	505	317
*JG2REJ	*	387,904	394	352
*EA5ASF	A	252,600	414	300
*IN3NJB	A	129,600	230	225
*9A3ZG	A	83,496	271	196
*AN1FBJ	*	74,298	248	183
*JK2VOC	*	45,124	168	116
*9A3CY	*	36,600	143	120
*AN3DZZ	28	94,165	300	185
*PU2VYT	28	35,316	129	108
*GØDEZ	28	11,635	67	65
*AN5YJ	21	317,349	560	333
*PY2P	21	156,699	260	207
			(Op: PY2RIK)	
*JL6IPK	7	18,056	87	74
*YU1RA	1.8	27,664	132	104

MULTI-OPERATOR SINGLE TRANSMITTER

UNITED STATES

W6XR	11,231,169	3868	1047
WV2LI	9,314,195	3426	995
AA5NT	8,165,840	3124	1030
N3OC	8,135,677	3147	947
AA4NC	7,256,784	3032	872
NM5O	7,112,322	2936	987
KR5DX	6,912,928	3011	958
AJ1I	6,788,928	2723	912
KRØB	6,705,096	2737	982
KD9ST	5,947,688	2590	866
W6YX	4,057,704	2042	776
KO7X	3,932,087	2084	761
NT4TT	3,393,000	1724	780
KØGQ	2,827,032	1620	676
WØMA	1,968,780	1282	570
N9LCR	1,955,754	1246	607
NY4T	1,543,399	1116	559
WX6M	1,417,132	1074	554
W7IG	1,327,900	1002	542
N1XL	1,262,928	975	498
KD8SQ	1,220,750	930	514
AB2DE	1,164,324	799	501
AC4XO	1,082,400	853	492
KU4RG	918,916	803	452
W3LJ	841,620	733	415
KØDE	530,712	584	364
NY4I	281,892	401	278
W2TOI	628,948	646	388
KA1VMG	182,710	310	242
WB1GEX	77,616	215	154

NORTH AMERICA

VP5V	21,623,154	6615	1189
WP2Z	16,991,818	5824	1142
FM5BH	16,010,456	4981	1106
VE6SV	12,618,132	4011	1077
VA3MG	10,862,395	3564	1049
VE3RM	10,548,328	3696	994
VA3SK	9,825,237	3200	1017
TIØR	8,154,287	3401	919
V25WX	502,164	541	333
VE2CMH	493,452	548	324
VE1FQ	53,544	151	138

AFRICA

CQ9K	15,265,972	4303	1084
AN8URL	7,411,030	2755	890

ASIA

UPØL	13,023,592	3994	1031
YM3LZ	11,206,800	3780	880
RK9CWW	9,438,570	3159	995
JJ3YBB	7,826,304	2996	916
P39P	6,099,000	2670	760
JI2ZEY	5,485,832	2259	836
D73A	5,066,477	2261	793
JI2ZJS	3,752,250	1737	750
B4R	1,603,950	1444	578
BY4AOH	1,237,124	1512	476
BY4BZB	1,118,758	1076	499
RK9SWT	1,050,458	808	433
UN4L	973,384	750	433
JE4VVM	827,754	701	411
HLØO	763,476	718	427
RZ9WXK	677,484	597	369
HSØAC	647,361	756	429
JA5YGJ	614,172	565	381
BY2JCY	501,956	833	364
JN1YUU	129,270	282	186
JH2YSS	19,006	106	86

EUROPE

TM1C	16,768,719	5161	1177
GX6YB	14,475,669	5099	1131
YL4U	14,099,041	4848	1199
IY4W	13,886,082	4602	1154
OHØZ	13,675,615	4833	1135
9A7A	12,773,472	4505	1128
S5ØS	12,506,826	4061	1178
OH2U	11,859,170	4187	1091
OTØC	11,796,375	4065	1137
OF3F	10,786,717	4122	1091
RD3Q	10,304,665	3995	1135
OM5M	9,732,814	3706	1009
OM3A	9,430,115	3565	989
OH7M	9,378,600	3625	1100
OM7M	8,614,942	3546	973
Z3ØM	7,743,900	3534	996
RI3A	7,684,418	3567	1022
SP9LJD	7,452,928	3286	896
SN8V	7,139,876	2990	953
OTØP	7,057,169	2974	973
M2H	6,335,460	2940	915
DL2ARD	6,267,356	2774	901
G6A	6,005,692	2861	868
OH4AB	5,962,065	2774	955
GB3RS	5,699,196	2688	927
ES2X	5,472,000	2563	870
9A8M	5,360,315	2476	905
OL5Q	5,283,498	2624	831
S51MA	4,955,028	2387	897
OH6K	4,904,223	2561	887
EU5F	4,862,542	2752	862
DHØHTE	4,811,773	2370	853
AM4ST	4,702,848	2667	888
AN1COZ	4,687,744	2391	848
LX9SW	4,686,050	2422	850
TF3IRA	4,659,724	2839	844
IQ9K	4,617,756	2659	858
F9FE	4,447,140	2318	830
EA1EEY	4,302,262	2210	809
DL3KZA	4,210,920	2201	840
RK4WWA	4,145,316	2605	854
OK1KCI	3,953,664	2127	864
IK1SLE	3,760,232	2124	809
YL7C	3,362,718	1947	789
F5AMH	3,170,184	1822	744
YZ7A	2,933,126	1886	742
UX8IXX	2,833,320	1820	840
DL1YFF	2,693,520	1602	783
EA4RKU	2,670,570	1740	785
I4GAS	2,622,720	1568	683
4N7N	2,444,172	1567	706
AM3RKG	2,316,330	1602	690
LA7G	2,264,325	1592	681
SP9KDA	2,137,806	1535	649
DLØGH	2,048,032	1381	656
RK4FWX	2,001,996	1556	668
SPØZCC	1,946,544	1393	642
JW8G	1,926,848	1380	616
US8U	1,804,601	1549	629
GX3FEC	1,752,324	1297	644
ED5AQP	1,688,790	1401	615
OK2KDS	1,656,150	1205	610
OE/DL6FBL	1,539,332	1203	548
UR3IWA	1,490,346	1236	594
EN7Z	1,486,632	5058	1188
YT7P	1,361,220	1140	588
OK1KHL	1,311,596	1000	572
AN1AAW	1,263,605	1183	553
OZ2AR	1,140,825	992	525
OK2KOD	1,113,840	959	520
OZ1JTE	1,108,723	1000	539
AN1URG	1,074,744	975	531
OL1C	1,069,152	1070	518
F5EMP	1,064,655	971	531
AN5BX	1,049,475	1038	525
F5KON	975,260	851	484
OM3KWZ	933,634	926	482
F6KZC	924,647	927	499
AM4URA	867,510	1056	510
AM1RCT	802,785	909	491
RZ3DZF	796,824	835	476
DK9TN	776,310	754	458
SK7A	722,352	800	447
9A1V	675,917	788	473
OH2YLS	582,540	677	420
F8CGL	472,320	562	410
ES1XQ	458,568	570	396
SP9KDU	418,656	564	336
OZ7HVI	356,236	504	332
OM3KZA	356,208	496	328
SP9KRT	349,248	550	321
CS6RPA	333,244	520	352
SKØHB	244,496	393	296
RK3VWA	235,224	422	297
SP3KFH	229,914	347	241
SP5ZDH	193,936	373	272
SN6U	147,620	347	244
UT4UWL	112,497	279	231
OK2KRT	71,142	202	167
RZ1AWJ	12,144	109	88

OCEANIA

7AØA	6,502,840	2824	785
DX1CW	4,819,136	2362	694
VK4WIL	3,530,304	1856	648
AX2ØØØ	964,392	776	429
DX1DX	586,245	714	285
DX1RN	343,197	551	223
YBØZDC	173,840	94	212

SOUTH AMERICA

PTØF	21,776,546	6047	1121
LS7N	7,530,348	2772	942
PQ1S	5,153,607	2202	813
LU1FC	3,173,436	1600	686
LT5Y	1,280,037	917	491
LU4DRC	801,229	675	431
PY2ECP	493,050	525	346
PY2GEC	136,024	260	196

MULTI-OPERATOR MULTI-TRANSMITTER

UNITED STATES

KM3T	29,338,460	7,679	1,355
KT8X	26,642,082	7,363	1,362
NR6O	25,106,150	7,748	1,310
W4MYA	21,302,088	6,172	1,308
NQ4I	20,491,481	6,208	1,273
KI7Y	14,919,912	5,014	1,176
NK7U	11,610,216	4,311	1,107
K2BM	11,176,000	3,894	1,016
NE6N	9,818,802	3,667	1,046
KØAB	6,775,197	2,952	929
AD4TR	6,674,513	3,012	941
K3DI	1,016,506	774	454

K4WX operated as V25WX. If you had a bit of trouble hearing Don, it may have been because the microphone was not connected.

This is the shack of YV1AVO (YW1A in the contest). Italo had a very competitive score on 15 meters.

NORTH AMERICA

WL7E	42,013,215	9,911	1,395
KL7RA	34,835,360	8,906	1,330
VE5RI	16,151,750	5,172	1,150
VE6FI	14,428,336	4,441	1,136

ASIA

P3A	53,554,592	11,432	1,456
A61AJ	25,980,511	7,465	1,271
JA1YPA	13,824,173	4,309	1,111
JA3ZOH	11,588,400	3,778	1,080
UN4L	973,384	750	433
UN7LT	5,715	47	45

EUROPE

9AY2K	42,477,343	11,332	1,493
OTØA	42,191,136	11,036	1,528
4ØØA	37,780,209	10,665	1,487
S52Z	32,802,594	9,371	1,418
RU1A	26,094,584	7,923	1,348
HG6Y	24,365,425	7,572	1,325
ES5Q	21,522,480	7,105	1,288
LY7A	21,433,608	7,278	1,288
AN4URE	19,796,634	6,906	1,287
PI4COM	16,896,099	5,391	1,243
DLØWW	8,549,919	3,203	1,017
7S2ØØØM	7,117,872	3,472	1,028
OL7W	5,103,225	2,556	925
OK1KCI	3,953,664	2,127	864
SY1D	3,201,050	2,345	730
AN6IB	2,764,302	1,396	661
OE2S	1,781,022	1,212	646
DLØMA	1,657,006	1,247	631
M5W	1,128,695	1,054	545
AM4RAX	1,119,123	928	687
OH1N	34,848	137	121

OCEANIA

DX1DBT	1,627,920	1,437	380
DX1E	627,858	643	302

SOUTH AMERICA

ZX5J	46,550,452	10,039	1,508
4M4X	31,631,529	7,307	1,329
LU4FM	17,800,948	5,065	1,177
PY3MHZ	1,479,132	976	543
ZW5UF	742,850	637	415
LU1HYW	85,170	184	167

CHECKLOGS

The following logs were used for cross checking. SWL and check logs are always appreciated: 3Z8HXN, 4Z5GV, AM4WF, AN1CBX, AN8IK, CE5GD, CP1FF, CT1FNT, CT1GFQ, DH5MM, DJØMAQ, DK2DQ, DL/RX3AHL, DLØMPI, DL2AL, DL2MIH, DL3NM, DL4HQF, DL5AMF, DL5NA, DL7VGU, DL9ZWG, EA1AXH, EA1EBG, EA2RW, EA3ASX, EA3AYP, EA3BJM, EA3BSE, EA3CM, EA3CS, EA3URE, EA4CEN, EA4MD, EA5FME, EA5FSC, EA5GMA, EA5IY, EC5AKF, ER3DX, F/OK1EE, HA7PW, HG1S, IK2EBP, IR1S, IT9VCE, JA1JLP, K2DL, KX7J, LA2HFA, LA5YV, LA7NFA, LA9NM, LBØB, LB8AE, LU9APM, LX1ØXCY, LZ1KAM, LZ2PL, LZ2PS, LZ3BS, LZ3DB, NQ9M, OH1N, OH2PR, OK1AUP, OK1DKA, OK2BOV, ON4CJN, ON6CQ, OZ5MJ, PP5AM, PS7SAS, PT2CMN, PX5X, PY2TST, PY2YP, R3K, RA1NO, RA3AD, RA3MB, RA9FF, RK1ZXN, RU3DG, RV3QH, RV6HA, RW1QM/1, RW4PX, RW4WE, RW6AML, RX3AHR, SMØBDS, SMØBNK, SM2UJW, SM5CVC, SP 3ØØ3 LG, SP1DMD, SP1HM, SP1JON, SP3BVI, SP3MEP, SP4GFG, SP4KEV, SP4SHD, SP5CEQ, SP6NVK, SP6OJG, SP6PCM, SP7ICE, SP7RFF, SP8FHM, SP9CQ, SP9MCU, SP9MDY, SQ5BPM, SQ8AMD, UA1AKE, UA1OMX, UA1ZMD, UA3AHA, UA3BM, UA3MOM, UA3NDR, UA4RC, UA4YJJ, UA9CDB, UA9OX, UT2XX, UT5JDS, UUØJC, UW7I, UZ4E, VA3TEE, W6HG, W6QU, W8QZA, WA2BMH, WA8WLO, WA9PSV, YC7URA, YO2AIX, YO3JOS, YO4AB, YO4ATW, YO6OFC, YO7DMX, YO7LBX, YO9DFQ, YV3AZC, YW3B, ZSØE.

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trolled by high-pressure gas—helium in this case—similar to an air-powered wrench.

On December 11th, a burn to raise AO-40's apogee (the high point of its orbit) was planned but didn't take place. The sequencer program went through its steps, but the helium system didn't pressurize the engine's valves. The command stations determined that the command was sent but didn't pressurize the system. Without pressure in the valves, the propellants couldn't mix and the engine couldn't fire.

Additional commands were sent to start the helium flow and cycle the valves, but the pressure was far less than what was expected. The replanned burn occurred on time, but lasted almost three minutes longer than planned. This resulted in a far higher orbit than originally intended. While not a long-term concern since the orbit needed eventually to be raised to that height, it certainly indicated major problems with the propulsion system.

All telemetry stopped on December 13 at 11:16 UTC. The spacecraft was in the process of being commanded by a ground station when the telemetry suddenly disappeared. However, AMSAT has not said what commands were being issued at the time. An AMSAT bulletin said that ground controllers were trying to figure out what was wrong with the propulsion system when the telemetry stopped. Spacecraft propellants are extremely volatile and must be treated with the highest respect. It's possible that a major failure occurred in AO-40's propulsion system, or in plain English, an explosion blew a hole in the side of the satellite. However (see below), radar imaging after the shutdown indicates that the satellite is still in one piece.

Glimmers of Hope

As we go to press, there are a few glimmers of hope that the spacecraft may still be alive. The IHU-1 (Integrated Housekeeping Unit) "brains" of AO-40 expects to receive commands on a regular basis. If it doesn't receive any commands for a long period of time, it goes into a reset mode where it reloads its command program and "reboots" the spacecraft. The first potential restart time came and went on December 16th without any confirmed transmissions.

According to the ARRL, Peter Guelzow, DB2OS, of AMSAT-Germany's, said command stations tried to re-establish communication by sending blind commands after the time for the automatic reset had come and gone. Geulzow pointed out that the reset might have happened but not been heard by controllers. He said it would have restored AO-40 to its post-launch configuration, meaning the satellite would attempt to transmit on 70 cm. However, the 70 cm transmitter has not worked since launch, and Geulzow said the satellite likely would still need to be reconfigured for 2 meter transmission at that point to be heard on Earth.

At press time, the next "event" for which controllers were waiting would come on December 21, when a "command-assist" watchdog routine was scheduled to cycle the satellite through various receive, transmit, high-gain, and low-gain antenna modes. However, this could be delayed if the satellite *did* manage to pick up any of the "blind commands" sent by ground controllers. In that case, Guelzow told the ARRL, the command-assist watchdog would be reset for another 10 orbits, extending the wait until sometime after Christmas.

Guelzow says the "watchdogs" are software resets. Ground controllers want to avoid doing a hard re-boot of the main computer, which is considered a last resort. "There is no need to hurry, and the command team doesn't want to miss any option," he said. A hardware reset command would be independent of the IHU and can reset the spacecraft if the computer has locked up. However, it's considered an extremely drastic step and should only be done after all other steps have been exhausted.

Other good news is that on Sunday, December 17th, USSPACECOM (the agency, a part of NORAD, that tracks everything in orbit around the Earth) was able to "ping" AO-40 with its radar and generate a new set of Keplerian elements for it. According to AMSAT, the radar cross section was as expected with no other pieces found nearby.

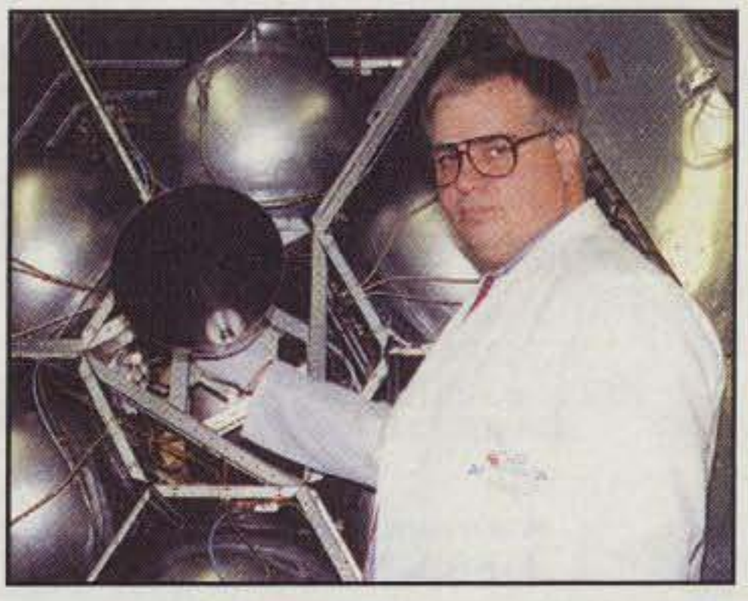
"This should end speculation of an explosion, as NORAD found only one object with a radar cross section that was consistent with a satellite the size of AO-40," noted the AMSAT News Service.

It also seems that the satellite is where ground controllers thought it should be, so at least they're pointing their antennas in the right direction.

Also on the positive side is the fact that AO-40's telemetry beacon was received by several ground stations when it stopped. Thus, there's plenty of data for the engineers to try to determine what went wrong. Plus, there have also been several reports of hearing a weak, unmodulated signal on or near AO-40's 2 meter beacon frequency, which ground controllers are investigating. *CQ* will keep you posted on further developments via its website and e-mail newsletter.

A Look to the Future

If AO-40 is recovered, then the command team may decide not to use the large engine anymore. This would mean AO-40 could never reach its final planned operational orbit, but possibly the smaller arcjet engine could be used to get a reasonable compromise orbit with reasonable coverage.



At the Phase 3D Integration Lab in Orlando, Florida, AMSAT volunteer Rick Leon, KA1RHL, holds the 400 Newton motor in place against the body of the satellite. The tanks surrounding the motor contained the propellants.

In this writer's opinion, it would have been much more desirable if AO-40's management and control operators provided more information to the ham community. The control stations clearly had their hands busy operating AO-40, but occasionally chose to respond to statements which they wanted to correct while ignoring other requests for information. Also, while the control operators may not have had time to respond, the high-level managers could have—if they chose to do so. Instead, the folks who contributed the funds and time to building AO-40 were left in the dark, other than admonishments of "Don't speculate" or "Don't spread rumors that the spacecraft is unhealthy."

There's a pretty good scene from the television series "West Wing" in the recent episode "Galileo V" about the failure of a space probe. The President was scheduled to speak to school children about the space program and was having second thoughts due to the failure, but his press secretary persuaded him otherwise:

"We have, at our disposal, a captive audience of school children," she said. "Some of them don't go to the blackboard or raise their hand because they think they're going to be wrong. I think you should say to these kids, 'you think *you* get things wrong sometimes, you should come down here and see how the big boys do it.' I think you should tell them you haven't given up hope and that it may turn up. Some of them will laugh and most of them won't care, but some of them will realize it's about going to the blackboard and raising your hand." Or in other words, you may not succeed if you try, but you certainly won't succeed if you don't try. Something to remember.

Let's hope we're premature—or just plain wrong—with the following:

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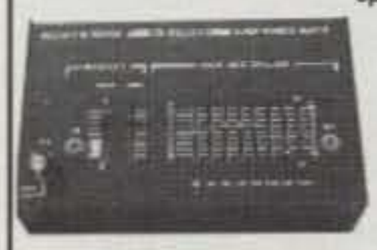

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BP-83xh NiMH pk.	**7.2v**	**1650**mAh	**$39.95**
BC-79A	**Rapid/Trickle Charger**		**$52.95**
For KENWOOD TH-79A / 42A / 22A etc.:			
PB-33xh NiMH pk.	**6.0v**	**2000**mAh	**$39.95**
PB-34xh 5w NiMH pk.	**9.6v**	**1100**mAh	**$39.95**
For KENWOOD TH-235 etc. (Hard to find !):			
PB-37 (Kenwood-brand)	**12.0v**	**950**mAh	**$29.95**
For KENWOOD TH-78A / 48 / 28 / 27 etc:			
PB-13x (orig. size pk,NiMH)	**7.2v**	**1300**mAh	**$34.95**
PB-13xh NiMH pk.	**7.2v**	**1650**mAh	**$39.95**
BC-15A	KENWOOD brand Fast Charger		**$39.95**
For KENWOOD TH-77, 75, 55, 46, 45, 26, 25 etc.:			
PB-6x (NiMH, original size)	**7.2v**	**1200**mAh	**$34.95**
NEW for KENWOOD TH-205 / 215 / 225 / 315 etc.:			
PB-2h NiMH pk.	**8.4v**	**1200**mAh	**$39.95**
NEW for KENWOOD TH-2500 / 2600: EXCLUSIVE !			
PB-25s NiMH pk.	**8.4v**	**1200**mAh	**$39.95**
Packs for ALINCO DJ-580 / 580T / 582 / 180 / 280T etc.:			
EBP-20nh NiMH pk.	**7.2v**	**1800**mAh	**$32.95**
EBP-22nh 5W NiMH pk.	**12.0v**	**1500**mAh	**$36.95**
EDH-11	**6-Cell AA case**		**$14.95**
For YAESU FT-50R / 50RD / 40R / 10R etc.:			
FNB-41xh NiMH pk.	**9.6v**	**1100**mAh	**$45.95**
For YAESU FT-51R / 41R / 11R etc.:			
FNB-33xh NiMH pk.	**4.8v**	**2000**mAh	**$39.95**
FNB-38 5W NiMH pk.	**9.6v**	**700**mAh	**$39.95**
For YAESU FT-530 / 416 / 415 / 816 / 76 / 26 etc.:			
FNB-25x NiMH pk.	**7.2v**	**1000**mAh	**$28.95**
FNB-26xs NiMH pk.	**7.2v**	**1800**mAh	**$36.95**
For YAESU FT-411 / 470 / 73 / 33 / 23 etc.:			
FNB-10 NiCd pk.	**7.2v**	**600**mAh	**$20.95**
FNB-11 5W NiCd pk.	**12.0v**	**600**mAh	**$24.95**
FBA-10	**6-Cell AA case**		**$14.95**

NEW- the IQ-9000 Charger & Conditioner for AA & AAA batteries! **$22.95**
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Today's elite-class operators demand the best RF weaponry available. Yaesu's exciting new MARK-V FT-1000MP answers the call, with an expanded array of receiver filtering, 200 Watts of power output, and Class-A SSB operation capability for the cleanest signal on the band. Enhanced front-panel ergonomics save you seconds in a pile-up or a contest "run," and Yaesu's HF design and manufacturing know-how ensures that no short-cuts have been taken in our effort to bring you the best HF transceiver money can buy. For more QSOs in your log, and more awards on your wall, there is only one choice: the MARK-V FT-1000MP from Yaesu!

I. IDBT: Interlocked Digital Bandwidth Tracking System

The IDBT feature greatly simplifies operation by matching the bandwidth of the DSP (Digital Signal Processing) system to the net bandwidth of the 8.2 MHz and 455 kHz IF stages. The IDBT system accounts for the settings of the IF WIDTH and SHIFT controls, and automatically sets a DSP bandwidth which matches the analog IF bandwidth.

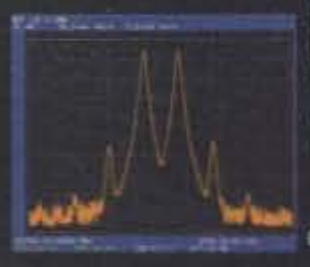
IDBT: A Breakthrough in Selectivity!

II. VRF: Variable RF Front-End Filter

Protecting the MARK-V's receiver components from strong out-of-band signals, the VRF system acts as a high-Q "Preselector," located between the antenna and the main bandpass filter networks, providing additional RF selectivity on the 160-20 meter Amateur bands for multi-operator contest teams, DX-peditions, or for operation near MW/SW broadcast stations.

III. 200 Watts of Transmitter Power Output

Utilizing two Philips® BLF147 Power MOSFETs in a 30-Volt, push-pull configuration, the MARK-V's transmitter puts out up to 200 Watts of clean output power, thanks to the conservative design of the PA section.



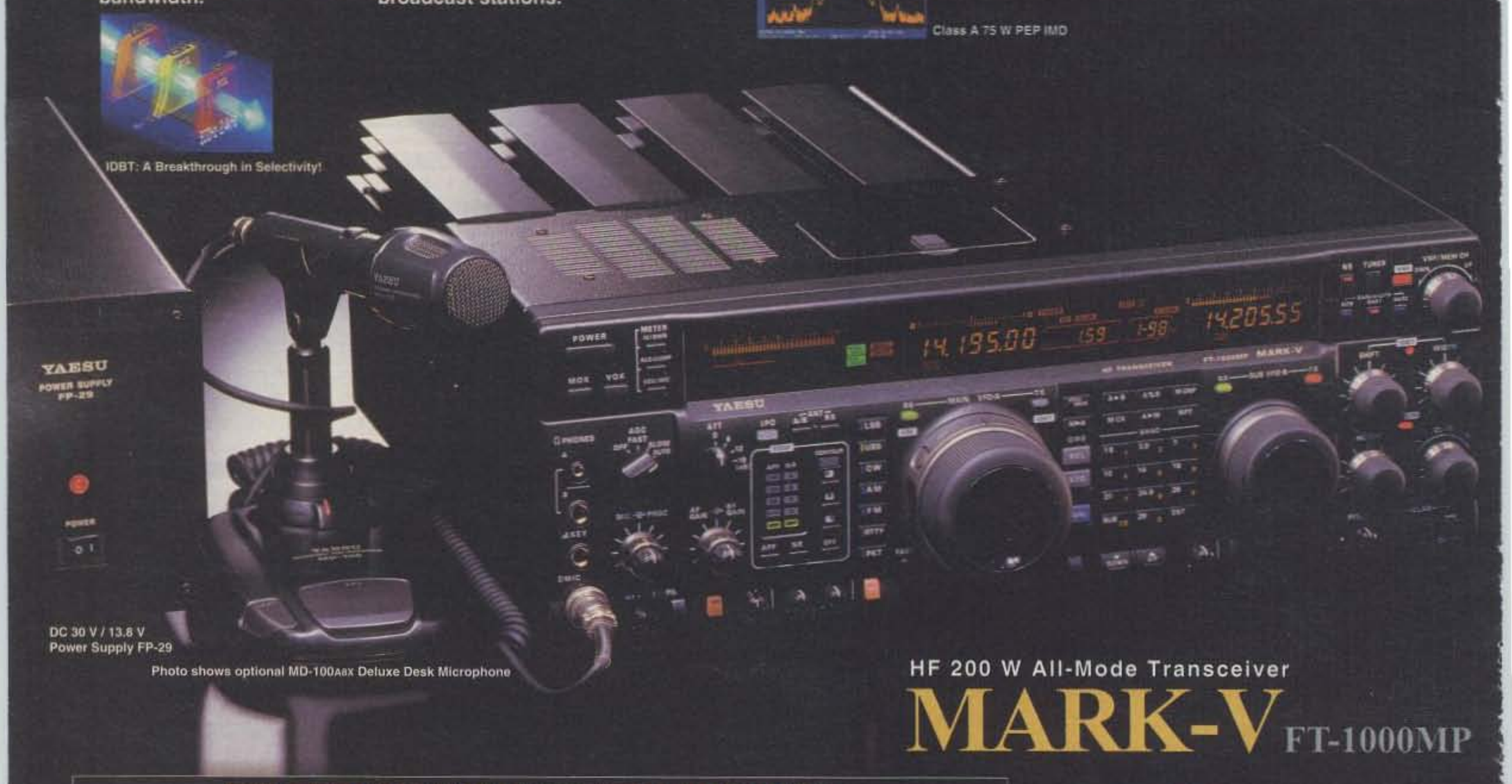
Class A 75 W PEP IMD

IV. Class-A SSB Operation

Exclusively available on the MARK-V FT-1000MP , a press of a front-panel button engages Class-A SSB operation of the transmitter, at a power output level of 75 Watts. Class-A operation produces incredibly clean signal quality, with 3rd- order IMD suppressed 50 dB or more, and 5th- and higher-order products typically down 80 dB or more!

V. Multi-Function Shuttle Jog Tuning/ Control Ring

The immensely-popular Shuttle Jog tuning ring, which is concentric with the Main Tuning Knob, has a new look in the MARK-V: it now includes the activation switches for the VRF (left side) and IDBT (right side) features, so you don't have to move your hand position to activate these important circuits during contest or pile-up situations!



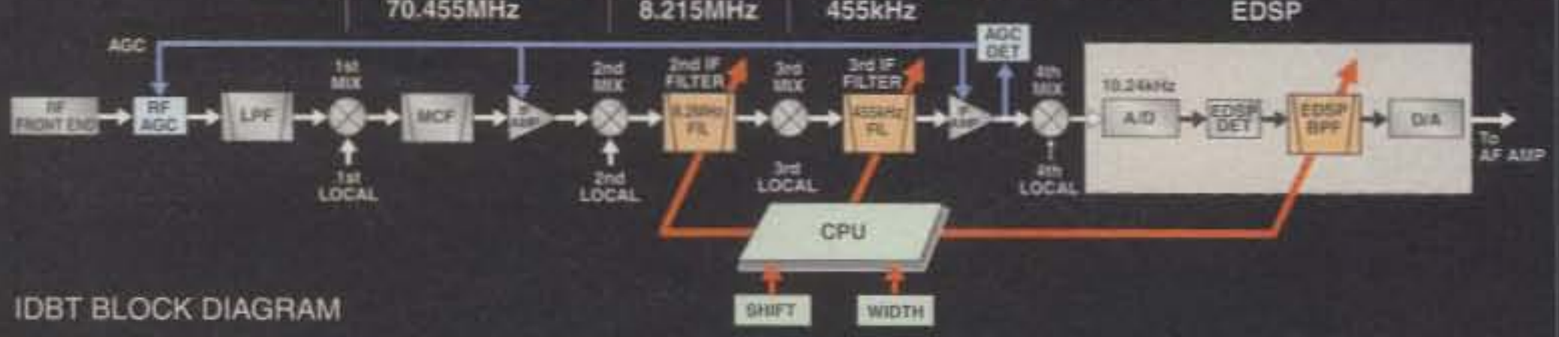
DC 30 V / 13.8 V
Power Supply FP-29

Photo shows optional MD-100A8X Deluxe Desk Microphone

HF 200 W All-Mode Transceiver

MARK-V FT-1000MP

IDBT: INTERLOCKED DIGITAL BANDWIDTH TRACKING SYSTEM



IDBT BLOCK DIAGRAM

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Actual Size

Bring Ham Radio along on your next hiking, camping, or business trip with Yaesu's amazing new FT-817 Multimode HF/ VHF/ UHF Portable Transceiver!

●ULTRA COMPACT: Measuring just 5.3" x 1.5" x 6.5" WHD (135 x 38 x 165 mm) and weighing about 2 1/2 pounds (1.17 kg, including the supplied antenna and alkaline cells), the FT-817 is small and light enough to take along wherever you're going.

●WIDE FREQUENCY COVERAGE: 160-10 meters on HF, plus the 50, 144, and 430 MHz Amateur bands. Plus FM Broadcast, AM Aircraft, and Public Safety receiver coverage.

●MULTIMODE DESIGN: Ready for action on SSB, CW, AM, FM, FM-Wide (Rx), 1200/9600 bps Packet, and Digital, including dedicated USB and LSB PSK-31 configurations.

●5 WATTS POWER OUTPUT: Using a new-technology all-band MOS FET power amplifier, the FT-817 provides 5 Watts of power output when using a 13.8 Volt DC source. When using Alkaline batteries or the optional FNB-72 Ni-Cd Battery Pack, power is automatically set to 2.5 Watts; via Menu, this can be changed to 0.5 Watt, 1 Watt, or up to 5 Watts.

●WIDE CHOICE OF POWER SOURCES: The FT-817 is equipped with an alkaline "AA" cell battery case, and a 13.8 volt DC cable is also supplied. Available as an option is the FNB-72 Ni-Cd Battery Pack (9.6 V, 1000 mAh), which can be recharged using a 13.8 Volt power supply while the radio is being operated.

●TWO ANTENNA PORTS: A "BNC" connector is provided on the front panel, and a type "M" connector on the rear panel, with Menu selection of which connector will be assigned for operation on HF, 50 MHz, 144 MHz, and 430 MHz.

●OPTIONAL 10-POLE COLLINS MECHANICAL FILTERS: An optional filter slot is provided, accommodating either the YF-122S (2.3 kHz) SSB filter or the YF-122C(500 Hz) CW filter. You get "base station" performance even from a mountain top.

●INCREDIBLE MEMORY RESOURCES: You get a total of 208 memories, including 200 "regular" memories which may be separated into ten groups of up to 20 channels each. And you can append an Alpha-Numeric "Tag" to each memory to aid in channel identification.

●A CW OPERATOR'S DREAM MACHINE: You get a built-in Electronic Keyer with adjustable weighting, adjustable CW Pitch, CW Normal/Reverse frequency tuning, and you can even use the microphone's UP and DOWN keys to send CW via the Keyer.

●BUILT-IN CTCSS AND DCS: The built-in CTCSS and DCS Encoder/Decoder systems provide you with the versatility you need for repeater access or selective calling.

●DUAL - COLOR LIQUID CRYSTAL DISPLAY: Select from Blue or Amber display illumination, which can also be switched off to conserve battery life. And while you're away, the Spectrum Scope will provide you with a visual record of activity ±5 channels from your current operating frequency.

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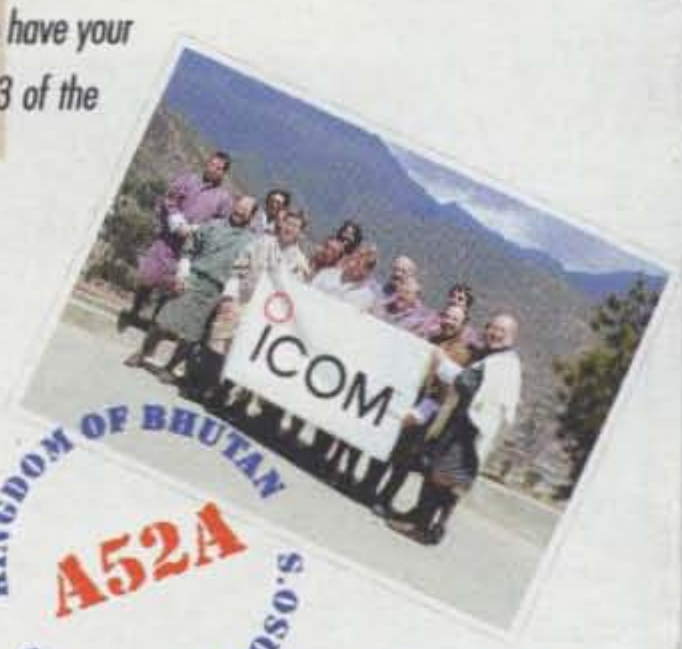
"Just back from K5K, Kingman Reef. The IC-756PROs again performed flawlessly and were a factor in our breaking 80,000 QSOs. I was a participant in FOØAAA, A52A and now K5K, all in 2000, and your radios made a combined 237,000 QSOs. You must be very proud to have your wonderful radios used by these DX'peditions that are now ranked as 3 of the top 6 Dx-peditions in terms of QSOs in the history of our hobby."

- K5K member, Bob Allphin, K4UEE



3 OF THE TOP 6 DX'PEDITIONS IN HISTORY!

Three of the top six DX'peditions in history!

Three remote locations!

38 operators!

The radios?

IC-756PRO

Just listen to the guys who actually used them - they know better than anyone what the power of 32 bit DSP technology can do for ham radio. In fact several members were so impressed that they bought '756PROs for their own ham shacks. "It just doesn't get any better than this" - says Glenn Johnson, WØGJ. Is it any wonder - the world's top DX'ers choose ICOM.

"All seven of the '756PROs worked flawlessly. We ran RTTY perhaps more than 50% duty cycle, and the radios never even got warm at maximum output. The digital filter controls were so easy to adjust and switch...a contester's dream! We had seven radios, most of the time with three modes at once on any given band. There was NO interstation interference. All of our antennas (except for the 160M & 80M verticals) were within a 75 meter circle."

- A52A member Glenn Johnson, WØGJ

" I was particularly impressed with the '756PRO's front end resistance to overloading. I never heard intermod noises or de-sensing even with the huge pileups we generated. Several times I listened carefully for such problems but they simply weren't there. On CW, once I had picked out a station, I could run the selectivity down to 50Hz and hear ONLY the station I wanted. I have worked pileups from several DX'peditions and have never encountered a radio that held up so well."

- FOØAAA member Mike Goode, N9NS.

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